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THE INSECTS OF PUERTO RICO

By *George N. Wolcott*

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THE INSECTS OF PUERTO RICO

By GEORGE N. WOLCOTT

"IN fourteen hundred and ninety-two,
Columbus sailed the ocean blue"

from Spain, westward from the Canary Islands out into the unexplored Atlantic. His first landfall, instead of being one of the expected spice islands of the East Indies, or some outlying representative of the ages-old and highly developed civilization of India or China, proved to be merely one of the smaller islands of the Bahamas, with only big-eyed, bronze-colored, naked Tainos as its human inhabitants. Returning the next year, at the peak of his temporal power and glory at the head of a fleet of seventeen ships, Columbus discovered the islands of the West Indies which bound the east and north of the Caribbean Sea. On this second voyage, when only twenty-one days out from Gomera of the Canary Islands, the grand fleet first sighted the steeply mountainous and forest-covered island of Dominica: one of the most southern of the Leeward Islands of the Lesser Antilles. Going ashore and taking posession for the Spanish Crown of Marie Galante, and really exploring Guadeloupe, Columbus passed the more northerly islands of Montserrate, Antigua, Nevis and St. Kitts in rapid succession, to land in St. Croix, and divide the fleet for exploring the "Eleven Thousand" Virgin Islands, of which forty-six were actually counted.

On the 18th of November, 1493, Columbus discovered Vieques, and all day on the 19th his fleet sailed westward along the southern coast of Borinquen, which the Admiral named San Juan Bautista, landing on the 20th on the west coast. Shore parties of sailors ate seagrapes, presumably from much larger trees than the low bushes that now line Puerto Rican beaches. How difficult to reconstruct that pre-Columbian Puerto Rico, with no irrigated fields of sugar-cane, no coconut palms, no grapefruit or coffee groves, no pomarrosa thickets, no mangoes, no flamboyán or tulipán to flaunt their masses of brilliant blossoms in the tropical sunshine, so oppressive to the Spanish sailors warmly clothed in woolen garments and mail! The mangroves along the shores were trees, not pollared bushes; with no terrestial animal present (except man) larger than bats and rodents, the grasses of the savannahs of the south coast grew high among the almácigos and ceibas,

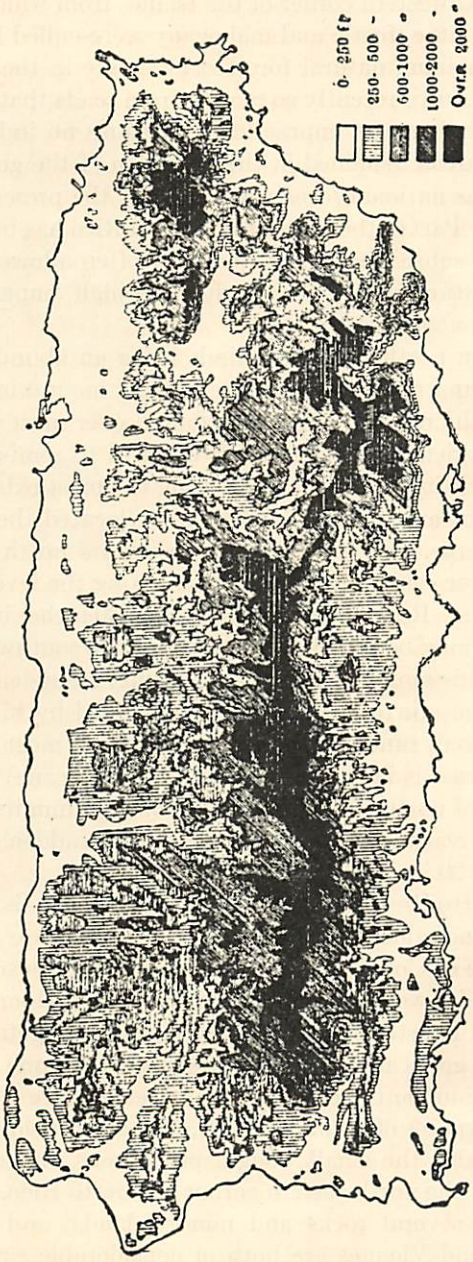
while massive trees of lignum-vitae, fustic, torchwood, cóbana negra, maga, úcar, algarrobo, moralón, ortegón and mahogany occupied level (agricultural) land, as well as the lower slopes of the densely forested mountains.

On the morning of the 22nd, Columbus' fleet started across the Mona Passage, sighting en route what he later named the Island of Mona. After extensive explorations in Hispaniola and Cuba, and circumnavigating Jamaica, Mona was again visited by Columbus less than a year later, in September 1494, at which time a landing was made and plantations of manioc, with enormous tubers, noted.

All of the West Indies which Columbus discovered have a tropical climate, the Tropic of Cancer passing just north of Habana, Cuba. Thus, for a longer or shorter period in the summer, the sun casts a southern shadow in these islands. Snow never falls on the peaks of the highest mountains, but the heat of the coastal lowlands is tempered by the prevailing northeast trade winds from the Atlantic. Typical of the West Indies also, are tropical hurricanes, one of which Columbus experienced: a constant threat in the late summer and autumn, when wind velocities may attain a speed of 150 miles per hour and cause enormous damage to vegetation and buildings.

While some of the myriad Virgin Islands are possibly most distant from the mainland, Puerto Rico is farthest removed of the larger islands. It is approximately a hundred miles long and forty wide, and so nearly rectangular in shape that it might well be used on maps, instead of the State of Pennsylvania, to give scale for comparison of size. Except for limited areas of mangrove swamps and rocky cliffs, most of the coast of Puerto Rico is a broad beach of shining yellow sand. A fringe of seagrape or coconut groves separates it from the meadows of dairy farms or the almost unbroken fields of sugar-cane which today occupy most of the more fertile land along the coast and extend up the stream valleys for a few miles into the mountainous interior.

Most of the island was wooded at the time of its discovery by Columbus, for the resident Indians lived mostly by fishing, and their settelments along the coast were surrounded by very limited cleared areas of corn, yuca, yams, cotton and tobacco under cultivation. Forests of a sort still cover a large part of Puerto Rico, but most of these are artificial forests: coconut groves along the coast, citrus groves a little farther inland on sandy areas along the north coast, and trees of coffee and their accompanying shade trees in the central and western portions of the Island. On the more level land of the interior, pineapples and tobacco are the principal commercial cultivated crops grown, but one sometimes sees land being plowed so steep that the feet of one ox of the yoke are level with the horns of his mate. We can have little conception of the magnificent character of the virgin forests of the coastal region of Puerto Rico, for all that remains are rocky areas of



PHYSIOGRAPHIC MAP OF PUERTO RICO

scrub in the arid southwestern corner of the Island, from which all marketable trees of lignum-vitae, fustic and mahogany were culled long ago. In the interior, the remaining natural forested areas are in the more rugged mountainous regions, until recently so remote from roads that dragging out the most valuable timber was impractical. Because no individual could exploit them, these areas remained in the posession of the government, to be later designated as national forests and only at the present time made accessible by roads. Part of the interior of Puerto Rico has been cleared of forest for planting of subsistence crops, and later often allowed to grow up to little cared-for pasture, with guava bushes and high, unpalatable weeds gradually crowding out the cattle.

The moisture-laden northeast trade winds bring an abundance of rainfall to Puerto Rico, and as the highest intercepting mountains are close to the southern coast, the rainfall is well distributed over most of the Island. Economically and agriculturally, however, the arid to semi-arid southern coast is of the greatest importance, constituting the most extensive area of level land devoted to cane-growing, and here are located the largest mills for grinding sugar-cane. By constructing reservoirs north of the main mountain range, water can be collected for irrigating the level coast south of the mountain ridge. Rainfall averages less than 30 inches in a year along the south coast, and may be less than 20 inches at the southwestern corner of the Island. As this mostly comes in the spring, a sudden profusion of leaf and bloom in the unirrigated areas, accompanied by bird and insect life, replaces the barren, sunbaked brown desolation of most of the rest of the year. The contrast is in the tropical rain (or hurricane) forests of the Luquillo mountains of northeastern Puerto Rico, the summits of which are almost continually wreathed in clouds and subject to sudden downpours of rain that total over 100 inches in a year.

To the west of Puerto Rico, about half way to Hispaniola, is Mona Island, a high, level table-land, almost uninhabited by man and less cultivated by him than at the time of Columbus, with a narrow sandy beach for landing by boat or plane on its western edge. The climate of Mona is similar to that of southwestern Puerto Rico, and its desert scrub vegetation, thinned by innumerable wild goats and pigs, supports much the same kind of insect life, but plus some abundant species not found on the larger island. Officially and for the purposes of administration, Mona is considered as part of Puerto Rico, as is also the small, rough, precipitous and entirely uninhabited Desecheo off the northwestern corner of Puerto Rico. To the east of Puerto Rico are several rocks and minor islands, and Culebra and Vieques. Culebra and Vieques are both of considerable size, reasonably level, and in considerable part agriculturally exploitable despite a scarcity of rainfall. Their climate and natural vegetation are so similar to that of

eastern Puerto Rico that no insects not occurring in Puerto Rico have been found on them.

Except for raids on settlements by pirates, and attacks by the English and Dutch on San Juan, Puerto Rico has been at all times continuously under the Spanish flag from the time of its discovery by Columbus up to its occupation during the Spanish-American war by troops of the United States Army. Of the naturalists who became famous for their observations and collections in other islands of the West Indies and elsewhere in tropical America during this period, Puerto Rico appears to have attracted less than a fair proportion. The earliest recorded collection of insects in Puerto Rico was made by the Botanist, André Pierre Ledrú, and is reported in his "Viaje a la Isla de Puerto Rico en el Año 1797", Paris 1810. Of the forty-six insects listed under their scientific names, ten can be readily identified and one can guess at the identity of many of the others. But none of these, it should be noted, was described from Puerto Rico as new: all were old, previously described species, widely distributed elsewhere in tropical America.

A collector for the Royal Zoological Museum in Berlin, Herr C. Moritz, as recorded in his "Notizen zur Fauna der Insel Puertorico" (Wiegmann's Archiv für Naturgeschichte, **2**: 373-392. Berlin, 1836), coming from the Danish islands of St. Thomas and St. John, landed at Arecibo on February 17, 1835, in an open boat on the beach, where he noted Cicindelids (presumably *Cicindela trifasciata* F.) and small Carabids "umherschwärmten." Riding "nach der dort eigenthümlichen Art auf Körben", he passed thru "mit Tabackspflanzungen umgebene" Manatí en route to San Juan. He started across the Island to Caguas "von der hier als Augengift verschrieenen *Volkameria fragrans* durchduftet," passed the hot springs of Coamo to Ponce "mit weiten üppigen Zuckerfeldern," and thence proceeded to Guayama and Yabucoa, where he made his "Aufenthalspunkte" for several months.

His account, written at Caracas, Venezuela, in January 1836, apparently was prepared before determinations of the insect material sent to Germany had been received. In consequence, many of the insects which he observed are identified no more exactly than by comparison with European forms, of others only the genus is listed, but a few of his identifications are entirely correct. We can be certain of the identity of nine butterflies, and guess at that of several others. Of some insects, his descriptions of appearance, host and habits makes identification reasonably certain. For the more conspicuous larger animals, birds, plants and trees, Herr Moritz uses local names, and also for a few insects, such as "cucubano" and "comehen."

The organization of his material might be called romantic ecological, the

final purple passage of environmental description coming to a climax with the record of a whirligig beetle, the olive-green *Gyrinus longimanus*, which Herr Moritz incorrectly states also occurs in Patagonia. (Olivier originally described *Dineutes longimanus* from Cuba, and its known distribution outside of the Greater Antilles extends only to Costa Rica.) His romantic point of view excludes from consideration the local development of agriculture, for the only additional mention of crops is of corn growing in clearings in the woods. The clusters of mountain palms and royal palms (the latter called "kohlpalm" and not "palma real" by Herr Moritz, in this case surprisingly insensitive to the lack of esthetic implications of the cabbage), the moist grassy banks of streams in the shade of bamboos, the wild, grass-grown "poyales" (quite different in his day from the poorly-drained cane fields of the present) and the coming of twilight illuminated by the flashes of light from five kinds of Lampyrids and the "cucubano" are described minutely and with feeling, only to be followed by prosaic lists of the insects, especially beetles, which he found present.

In this collector's paradise, admittedly there are "Niguas (*Pulex penetrans*), die Musquitos (*Culex fasciatus et al. sp.*), Sandfliegen (*Simulia*), kaum grösser als ein Sandkorn, die grösste Stechfliege (*Chrysops*), dagegen sah ich keinen *Tabanus*". After emphasizing the absence of poisonous snakes in Puerto Rico, Herr Moritz has much to say of the smaller poisonous animals, being especially impressed with the size of the "Guavá, Krabbenspinne (*Phrynus reniformis* Latr.)," which he measured with care. "Der Biss der Guavá soll für Menschen tödtlich sein, den grössern Vich wenigstens unheilbare Beulen verursachen, wie ich sie bei Pferden, von der Grösse eines Menschenkopfs, am Bauche herabhangen sah." The local tarantula he found living "stets in Baumhöhlen;" a centipede is listed correctly as *Scolopendra morsitans*, with no comment on its habits. A millipede "bei Berührung einen ätzenden, die zarte Haut entzündenden Saft, der dem Auge selbst Blindheit verursachen soll, von sich spritzen." Aside from this, however, he describes only a bountiful Nature, "von deren Erzeugnissen man hat bisher noch so wenig wusste," even the spider *Epeira argentata* F. having a beautiful web and silvery spots more permanent after death than those of the golden Cassid beetles on the leaves of *Convolvulus*, or the leaf-rolling Attelabid weevils on *Psodium pomiferum* (now called *Psidium guajava*), of whose "goldener Schulterfleck sich nach dem Tode in ein mattes Gelb verwandelt." In addition to cockroaches and mantids, a wingless nymphal walking-stick, (*Phasma*) was noted, of which he later in Venezuela found what he supposed to be its winged adult.

No mention is made of dry-wood termites, presumably rare in such an undeveloped country, but to the habits and destructiveness of "Comehens, *Termes fatalis* et al. sp.", building nests as large as "Bienenkörbe," half

a page is devoted. His references to Hemiptera are less exact, European names being given for the aquatic forms collected, cicadas and Cimicidae noted as attracted to light, and Lygaeids found on *Sida rufescens* and *Asclepias curassavica*. In addition to listing genera of beetles found at light and in various environments, Herr Moritz records finding on "Oenotheren" (now called *Jussiaea angustifolia*) the "ansehnliche dunkelblaue in Violet spielende" Chrysomelid beetles of *Galerucella* (now *Altica* or *Haltica*) *Jamaicensis* F. He identifies correctly *Hololepta 4-dentata* F. under the leaf-sheaths of fallen palms, and finds *Calandra sericea* (=*Metamasius hemipterus* L.) larvae feeding on the pith, and "zur Verwandelung in ein dichtes Knäuel von Blattfasern sich einhüllt." He noted a little black and white curculio on *Solanum torvum* which had already been described by Olivier in 1807 under the name *Rhynchaeus* (now called a *Baris*) *torquatus*, the type from Puerto Rico.

The famous Cuban naturalist, Dr. Juan Gundlach (born in Germany, and christened Johannes Christopher Gundlach, see the biography by Charles T. Ramsden in "Entomological News", **26** (6): 241–260, pl. 2, Philadelphia, June 1915), urged by the German vice-consul Herr D. Leopoldo Krug, representative of the firm Lemeyer y Cia., in Mayagüez, came to Puerto Rico in 1873, and together they collected in the western end of the Island. In 1875, Gundlach made a second trip to Puerto Rico, this time as the guest of Dr. Augustín Stahl, with whom he collected in the Bayamón region. In 1881, Gundlach made a third and final trip to the Island. The collections he had made with Krug and Stahl were sent to Berlin, where they were studied, classified and many new species described by various specialists. Between May 1887 and September 1893, Gundlach published the sections dealing with insects of his "Fauna Puerto-Riqueña" in the Anales de la Sociedad Española de Historia Natural, Madrid, embodying the results of his collections and studies. This paper will remain a lasting monument to his energy, perseverance and industry in advancing systematic entomology in Puerto Rico. As he was the old-fashioned, unspecialized type of naturalist, interested in all phases of the specimens he collected, his notes also include records of host plants observed, especially if these were of economic value.

By comparison with the relative aridity of investigations in natural history or any other science (excepting only those of C. W. Morse in the electric telegraph when he was living near Arroyo) in Puerto Rico during the centuries when it was under Spanish rule, the promptness and energy with which all sorts of such projects were initiated after the change in government in 1898 forms a most striking contrast. The U. S. Fish Commission sent the U. S. S. "Fish Hawk" for two months (January–February 1899) to investigate the marine life around Puerto Rico, and on board was a repre-

sentative of the Division of Entomology: Mr. Aug. Busck. He had been directed to collect especially scale insects, as only one previous record was known from Puerto Rico, as well as to make observations on the insects of economic importance, such as the "changa". He returned to Washington having collected 800 to 900 species of insects, some of which have not been described until recently, as well as many spiders and myriapods.

In May 1901, Mr. D. W. May, representing the U. S. Department of Agriculture, established an experiment station at Rio Piedras, which in September 1902 was transferred to its permanent location at Mayagüez. The early reports of its first Entomologist and Botanist, Mr. O. W. Barrett, concern especially the changa, and the coffee leaf-miner, of which he was the first to discover the minute parasitic wasps attacking the caterpillar.

This early period of the American occupation was one of material progress and change in many directions. The railroad from San Juan around the Island to Ponce and Guayama was completed; Mayagüez had a street-car system powered by Edison's newest and largest electric storage batteries; and Ponce a Stone and Webster system where recent graduates of M. I. T. could test in practise the theory they had learned in college. Mr. Pat McClain of Central Aguirre demonstrated such progress in cane-production that "mcclain" as a unit of cultivation became an essential part of the Puerto Rican language. Both Guánica Centrale and Central Fajardo had experiment stations, and in 1910 the Sugar-Producers' Association established an agricultural experiment station at Rio Piedras devoted entirely to the problems of cane production. The Board of Commissioners of Agriculture established a plant quarantine service, and also employed entomologists supplementing those of the Rio Piedras Station. It was high tide in entomological research!

Dr. Wm. Morton Wheeler, just beginning to be known for his work on ants, in March 1906 had visited Puerto Rico and Culebra to collect "The Ants of Porto Rico and the Virgin Islands" (Bull. Amer. Mus. Nat. Hist., **24** (6): 117–158, fig. 4, pl. 2, New York, 1908), with a party in charge of the Director of the New York Botanical Garden, Prof. N. L. Britton. Dr. Britton himself made no direct contribution to entomology in Puerto Rico, but his systematic botany of the Island, based on numerous extensive collecting trips, published in later years by the New York Academy of Sciences as parts of the "Scientific Survey of Porto Rico and the Virgin Islands", is of the greatest value to every working entomologist by enabling him to identify and name the specific host plants attacked by insects. Collections of insects by H. G. Barber, H. E. Crampton, F. E. Lutz, A. J. Mutchler and F. E. Watson, of the American Museum of Natural History, in Puerto Rico, and by Dr. F. E. Lutz in Desecheo and Mona were made on expeditions to these islands in connection with the Survey. Some pub-

lished numbers of the "Survey" deal with various orders of insects. They are of widely varying character: some are well illustrated, others not at all; some are by specialists who never visited the Island, others did their own collecting and knew Puerto Rico from personal experience.

Years before any of these "Survey" systematic entomological papers had even been planned, Mr. R. H. Van Zwaluwenburg, at the time he was Entomologist at the Mayagüez Station, prepared MS lists of all the identified insects in the collections of the two experiment stations. Based on these and Gundlach's paper, the writer compiled a more extensive annotated list, which, with a supplement, was later expanded to " 'Insectae Borinquenses', with a host-plant index by José I. Otero", (Jour. Agr. Univ. P. R., **20** (1): 1–627, illus., Río Piedras, July 10, 1936), of which a supplement appeared in 1941.

Rather than attempt a new list at the present time, including the rather considerable amount of new records that has since been accumulated, especially those in Prof. J. A. Ramos' master's thesis "The Insects of Mona Island, West Indies" (Jour. Agr. U. P. R., **30** (1): 1–74, pl. 2, ref. 45. Río Piedras, 1947) it seems more desirable by presentation in what it is hoped will prove to be a simplified form, to remedy some of the complications in attempting to use all of this material. The name of every recorded insect is given, but not the confusing mass of accession numbers of the collection at the Rio Piedras Station and of the interception numbers of the Federal Plant Quarantine Service of the San Juan Office of the Bureau of Entomology and Plant Quarantine, and locality records, unless especially pertinent, are generalized to biologic regions. It should be especially noted, however, that whereas ordinary entomologists collect insects, the Plant Quarantine Inspectors invariably "intercept" their insect material, and this distinction is observed in the following pages.

For convenience, the more pertinent data concerning the professional resident and some of the visiting entomologists are here presented in semitabular form. The only amateur to be noted is the clever, gifted, but erratic Cesário Pérez, who collected and reared butterfly caterpillars in Río Piedras and Arecibo regions, 1939–40.

C. G. Anderson (Plant Pathologist), Federal Plant Quarantine at San Juan, 1930–36.
B. A. App, Federal Station at Mayagüez, 1935–36.
J. W. Balock, Bureau of Entomology, at Mayagüez, 1935–36.
O. W. Barrett, Federal Station at Mayagüez, 1903–05.
Kenneth A. Bartlett, Federal Station at Mayagüez, 1935–.
N. O. Berry, Federal Plant Quarantine at San Juan, 1931.
I. W. Berryhill, Federal Plant Quarantine at San Juan, 1937–39.
Harold E. Box, Central Aguirre Station at Aguirre, 1924–27.
Luis A. Catoni, Insular Plant Quarantine at San Juan, 1919–.
W. W. Chapman, Federal Plant Quarantine at San Juan, 1941–46.

C. E. Cooley, Federal Plant Quarantine at San Juan, 1925–28.
Richard T. Cotton, Insular Station at Rio Piedras, 1915–18.
R. A. Crespo, Insular Plant Quarantine at San Juan, 1918–19.
S. S. Crossman, Tobacco Insect Station at Aibonito, 1912–14.
Ralph E. Danforth (the father), College of Agriculture at Mayaguez, 1921–27.
Stuart T. Danforth (the son), College of Agriculture at Mayaguez, 1927–38.
Donald De Leon, Tropical Forest Experiment Station at Rio Piedras, 1940.
H. L. Dozier, Insular Station at Rio Piedras, 1924–25. Federal Station at Mayaguez, 1935–36.
G. L. Fawcett, Insular Plant Quarantine at Mayaguez, 1913–15.
Richard Faxon, Federal Plant Quarantine at San Juan, 1930–35.
L. Courtney Fife, Federal Station at Mayaguez, 1935–36.
Raymond J. Fiske, Insular Plant Quarantine at San Juan, 1913–14.
Herschell Fox, Federal Plant Quarantine at San Juan, 1927–28.
Irving Fox, University of Puerto Rico at Rio Piedras, 1941–42.
Sanitary Corps, U. S. Army, 1942–46.
School of Tropical Medicine at San Juan, 1946–.
Julio García-Díaz, University of Puerto Rico at Rio Piedras, 1927–.
Geraldus Gay, Federal Plant Quarantine at San Juan, 1925–28.
Mansel C. Guerry, Federal Plant Quarantine at San Juan, 1946–.
Wm. Hanson, South Coast Laboratory at Guánica, 1915–16.
A. G. Harley, Federal Plant Quarantine at Mayaguez, 1929–35.
Wm. A. Hoffman, School of Tropical Medicine at San Juan, 1926–43.
Charles W. Hooker, Federal Station at Mayaguez, 1910–12.
W. F. Jepson, Phytalus Investigation for Mauritius, at Cidra, 1933.
F. A. Johnston, Federal Plant Quarantine at San Juan, 1940–41.
Thos. H. Jones, Sugar Producers' Station at Rio Piedras, 1911–14.
Joseph Kline, Federal Plant Quarantine at San Juan, 1946–.
Mortimer D. Leonard, Insular Experiment Station at Rio Piedras, 1930–32.
L. C. McAlister, Jr., Bureau of Entomology at Mayaguez, 1934–35.
Louis J. McConnell, Federal Plant Quarantine at San Juan, 1941–46.
W. A. McCubbin (Plant Pathologist), Federal Plant Quarantine at San Juan, 1935–39.
A. H. Madden, Federal Station at Mayaguez, 1935–36.
Luis F. Martorell, Insular Station at Rio Piedras, 1936–.
G. B. Merrill, South Coast Laboratory at Guánica and Tobacco Insect Laboratory at Aibonito, 1913–15.
A. S. Mills, Federal Plant Quarantine at San Juan, 1929–37.
John D. More, Insular Station at Rio Piedras, 1920–23.
Harold Morrison, Bureau of Entomology, July 1917.
James G. Needham, University of Puerto Rico at Rio Piedras, 1935, 1939–40.
Edgar Nelson, Insular Station at Rio Piedras, 1918–19.
R. W. Nicaise, Federal Plant Quarantine at San Juan, 1928–30.
R. G. Oakley, Federal Plant Quarantine at Ponce, 1931–37.
Herbert Osborn (the father), Aguirre, 1929.
Herbert Osborn (the son), South P. R. and Central Aguirre Station at Aguirre, 1928–31.
W. T. Owrey, Federal Plant Quarantine at San Juan, 1935–40, 1946–.
Boyd Palmer, Polytechnic Institute at San Germán, 1918–.
Mario Pérez, Insular Station at Rio Piedras, 1948–.
G. A. Pfaffman, Federal Plant Quarantine at Mayaguez, 1937–40.
H. K. Plank, Federal Station at Mayaguez, 1935–.

Harry D. Pratt, Public Health Service at San Juan, 1941–46.
A. Earle Pritchard, Public Health Service at Losey Field, Salinas, 1941–42.
J. A. Ramos, College of Agriculture at Mayaguez, 1938–.
John W. F. Rehn, San Juan, 1949.
L. B. Scott, Federal Station at Mayaguez, 1935–36.
Francisco Sein, Jr., Insular Station at Rio Piedras, 1920–48.
M. R. Smith, Federal Station at Mayaguez, 1935–36.
R. G. Smith, Federal Plant Quarantine at San Juan, 1939–40.
E. G. Smyth, South Coast Laboratory at Guánica and Insular Station at Rio Piedras, 1913–20.
H. D. Tate, Federal Station at Mayaguez, 1935–36.
H. G. Taylor, Federal Plant Quarantine at San Juan, 1935–39.
W. V. Tower, Federal Station at Mayaguez, 1906–11 and 1917–23.
C. P. Trotter, Federal Plant Quarantine at San Juan, 1928–30.
G. S. Tulloch, Federal Station at Mayaguez, 1935–36.
S. H. Vandeburg, Federal Station at Mayaguez, 1935–36.
D. L. Van Dine, Sugar Producers' Station at Rio Piedras, 1910–14.
H. L. Van Volkenberg (Parasitologist), Federal Station at Mayaguez, 1926–37.
R. H. Van Zwaluwenburg, Federal Station at Mayaguez, 1913–17.
F. A. Vitrano, Federal Plant Quarantine at San Juan, 1946–.
F. M. Wadley, Federal Station at Mayaguez, 1935–36.
S. D. Whitlock, Federal Plant Quarantine at Mayaguez, 1925–29.
George N. Wolcott, Insular Station at Rio Piedras, 1912–16, 1921–24 and 1931–.
G. M. Young, Federal Plant Quarantine at San Juan, 1944–.

Because the major economic pests have been studied so much more intensively, we know more about them and to be at all complete, even a summary account must give them a disproportionate amount of space. Thus, altho in places this may appear to be an economic entomology, it is only so by accident. Its arrangement is systematic, rather than ecological by crops or animals attacked, and the insects of interest for any reason are discussed regardless of their being neither harmful nor beneficial to the interests of man. First comes a discussion of some insect-like arthropods which are not insects.

CRUSTACEA

Crustaceans are for the most part aquatic arthropods such as crabs, lobsters, shrimps and sowbugs which breathe by means of gills, rather than thru tracheae as do insects, and they have two pairs of antennae instead of the single pair possessed by insects. The smallest crustaceans, often minute in size, which have no abdominal appendages are the Entomostracha, almost entirely marine forms. The one most easily observed in Puerto Rico is the cosmopolitan *Artemia salina* Linnaeus, which lives in the salt ponds of Cabo Rojo and Guánica. Since sea water is evaporated to dryness in these ponds to obtain crude salt, their waters naturally have a much higher concentration of sodium chloride than does sea water, but this apparently provides an optimum environment for this almost transparent little fairy shrimp. In the limited area of these salt ponds, it

occurs in countless millions, forming a unique association with the maggots of the fly *Ephydra gracilis* Packard, and the other specialized organisms which can live in such an environment.

Of the marine Entomostracha of the coasts of Puerto Rico, nothing is given in the "Investigations of the Aquatic Resources and Fisheries of Puerto Rico by the United States Fish Commission Steamer Fish Hawk in 1899" published in two parts as Bulletin No. 20 of the U. S. Commission of Fish and Fisheries (1900) 1902. But of the crabs and lobsters, the shrimps, the hermit crabs and the marine Isopods it gives an extended account, greatly expanding the records of the collections by Dr. Juan Gundlach. To it, anyone interested in the marine life of the waters around Puerto Rico is referred.

The beach fleas, *Orchestia platensis* Kroger, which occur in such abundance under the windrows and masses of decaying seaweed on the beaches inside the reefs where it is not carried away by the waves, hop about with greatest rapidity when disturbed. The seaweed is a nuisance to bathers, but if they attempt to sit or rest on it, the beach fleas soon acquire courage to take little bites out of this temporary addition to their environment. Maggots of the grey Tabanid fly, *Tabanus nervosus* Curran, also live in the decaying seaweed, and feed on the beach fleas, sucking out the body contents and leaving only the empty shell of the flea.

In addition to the fifteen marine sowbugs discussed by Dr. H. F. Moore in his "Report on Porto Rican Isopoda" (Bull. U. S. Comm. Fish and Fisheries, 1900, **XX**, pp. 161–176, pl. vii–xi. Washington, D. C., 1902), almost as many more have been recorded by Dr. H. J. Hansen from the waters around St. Thomas. Apparently the most abundant are *Cirolana parva* Hansen, found everywhere in West Indian and Bahaman waters as well as around St. Croix, St. Thomas and Puerto Rico, and *Cilicaea caudata* (Say), which is red or pink in life, from coral reefs around Puerto Rico. Two species of *Dynamene* occur on mangrove roots on Culebra.

From "under algae and drift alongshore" on Culebra were collected two semi-terrestrial species: *Ligyda baudiniana* (Milne Edwards) and *Philoscia culebrae* Moore. Under beach drift is hardly the normal environment for the latter species, which has repeatedly been found since in cane fields of the north coast, having made irregular, shallow cavities in live cane roots near the tip. "If these sowbugs are abundant, the cavities may be enlarged and all the surface of the tender root injured," writes Mr. Francisco Seín in his discussion of "The Sugar-Cane Root Caterpillar, *Perforadix sacchari*, new genus and species, and Other New Root Pests in Puerto Rico" (Jour. Dept. Agr. P. R., **14** (3): 167–91, pl. 10, ref. 18. San Juan, August 1930). Or, they may continue feeding where some other animal has previously eaten, greatly enlarging the original lesion. The sowbugs do not penetrate to any great depth in the soil, but live for the most part

under the trash close to the surface, and of the soil animals present, are least responsible for initiating injury to cane roots.

None of the common continental or cosmopolitan sowbugs is found in Puerto Rico, but *Cubaris murina* Brandt has been collected at Pueblo Viejo under stones, and three species are described by Miss Harriet Richardson from El Yunque: *Sphaeroniscus portoricensis*, *Philoscia richmondi* and *Synuropus granulatus* in her "Key to the Isopods of the Atlantic coast of North America, with descriptions of new and little known species" (Proc. U. S. Nat. Museum, **23**: 493–579. Washington, D. C., 1901). The latter species, unlike typical common sowbugs, which curl up so easily into a ball like the armadillo that generic names are *Armadillo* and *Armadillidium*, has so broad a body as "not able to be contracted into a ball".

The large, blue-grey land crab, commonly known as "juey", *Cardisoma guanhumi* Latreille, is a serious pest in low-lying cane fields close to the ocean, for it feeds on the leaves of young cane as well as on those of other plants. Its holes in the swampy ground are also a nuisance, and common practise among cane growers is to poison the crabs when they become abundant. A bar of the element phosphorus is placed in water in a five gallon oil can and heated. When dissolved, corn meal is added slowly until a paste in formed, and thickened until it is of the right consistency for application. A small quantity of the paste on a paddle is placed at the entrance of each crab hole, and the elimination of the crab is anticipated with certainty. Many people enjoy eating jueyes, when assured that they have not been poisoned. People living near the beach often develop a minor industry, catching the crabs by digging them out of their holes, or hunting for them at night with a blazing torch. The crabs, held in captivity in pens, are fattened on sweet potatoes and plantains, or rice and beans from the table.

Two kinds of fresh water shrimps, locally called "guábara", occur in the streams of Puerto Rico. *Atya scabra* Leach is the common cosmopolitan species; *Xiphocaris elongata* Guérin is found only in the fresh water streams of the Antilles. The former has "pereiopoda with exopodites", the latter is without. They attain a surprising size, even in the smallest streams, and are an item of food for man of considerable importance. They occur in the swimming pool on El Yunque and elsewhere in mountain pools, and by their bold inquisitiveness as soon as one ceases to move are a most tiresome nuisance to bathers.

PERIPATUS

Peripatus, the only genus of the class Onychophora, is distinctly not a typical arthropod. Indeed, the first specimens collected in St. Vincent of the Lesser Antilles were thought to be molluscs (L. Guilding "*Mollusca*

caribbaeana: an Account of a New Genus of Mollusca" Zoölogical Journal, **2**: 443, pl. 14. London, 1826), and it was only much later that it was discovered that they breathe thru tracheae like insects. This first collection was representative of numerous species present in the West Indies. *Peripatus* generally prefers moist habitats, as under dead leaves and stones, or in rotten wood, but one species, *Peripatus juliformis danicus* Bouvier, has been found in comparatively dry St. Croix, under rotten logs, and in the rotten stump of a mamey tree. *Peripatus dominicae juanensis* Bouvier, is the only species of Puerto Rico and Vieques. In the ecologically isolated mountain peaks of Presque Isle of southern Haiti, three additional subspecies occur, as well as *Peripatus manni* Brues and *Macroperipatus insularis* Clark, while individuals of only one other sub-species of *dominicae* Pollard have been found in all the rest of Hispaniola, according to Prof. C. T. Brues (Psyche, **46** (1): 36–7, map. Cambridge, March 1939). Numerous species occur in Jamaica, but none has been collected in Cuba (A. H. Clark, Proc. U. S. Nat. Museum, **85** (1): 1–3, Washington, D. C., 1937).

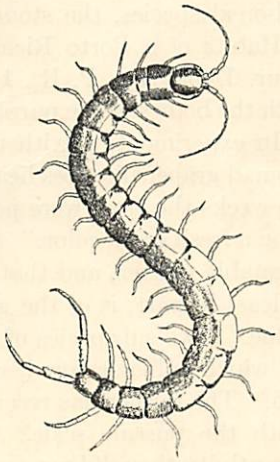
Peripatus shuns light, and two of the collections in Puerto Rico were in darkened bathrooms, in tubs in which the shower was dripping, at Río Piedras and Manatí, but others were in natural habitats, under forest litter, at Utuado and elsewhere along the north and west coasts. Three individuals were found in the mountains near Las Marías in piles of decayed yam leaves (October and November 1941).

The animals look somewhat like rather plump millipedes, usually dark in color, with a somewhat granular skin, but actually soft as a wet kid glove. They have long sensitive antennae and simple shining eyes, set like small diamonds on the side of the head. The females have 31 or more pairs of legs, the males of the same species usually a few pairs less. Adults of most species are often over two inches long, but some are little more than an inch in length.

When irritated, they eject from papillae beside the mouth a discharge of slime, which, altho apparently harmless and not adhering to the skin of the animal itself, is extremely sticky, and has been observed to be used in the capture of other small animals. The adults do not copulate. "The male deposits small, white, oval spermatophores, which consist of small bundles of spermatozoa cemented together by some glutinous substance, indiscriminately on any part of the body of the female," according to Adam Sedgwick ("Peripatus" *in* The Cambridge Natural History, pp. 1–26, fig. 14. MacMillan & Co., London, 1910). The young are produced alive and fully developed, gradually wandering off away from the mother.

SYMPHYLIDS

Much smaller and lighter in color than *Peripatus*, but possibly most closely related, are the Symphylids (Class Symphyla), which look like minute white centipedes. Even when adult, however, they have but twelve pairs of legs, and no eyes. The common international species (A. E. Michelbacher "The Biology of the Garden Centipede, *Scutigerella immaculata*, Hilgardia, **2** (3): 55–148, illus, many ref., Berkeley, January 1938) has not been collected in Puerto Rico, but another species, *Hanseniella* sp., has been found by Mr. Francisco Seín to be responsible for making "neat little round feeding cavities or pits, so common in cane roots in Puerto Rico that it is almost impossible to find a cane root without them." It has also been collected on similarly injured pineapple roots at Corozal, and presumably feeds on many kinds of plant roots in the more humid part of the Island. The injury is serious, but unless exceptional drought follows a period of high humidity favorable for the Symphilids, the plants continue to grow with what appears to us to be normal vigor.



The common centipede, *Scolopendra subspinipes* Leach, one-half natural size. (Drawn by Fritz Maximilien).

CENTIPEDES

Of the five less common species of centipedes (Class Chilopoda) recorded from Puerto Rico, Dr. Wm. M. Wheeler collected *Otocryptops melanostomus* (Newport) and *Otostigmus caraibicus* Kraeplin in the mountains above Utuado; two species, *Cupipes guildingi* (Newport) and *Geophilus culebrae* Silvestri, are found in Culebra, while *Scolopendra*

morsitans Linné, generally greenish in color, is a widely distributed species. The common species of coastal Puerto Rico, also present in all the other West Indies from Cuba to Trinidad, is *Scolopendra subspinipes* Leach. Despite its nocturnal habits, it is bright with red, orange and clear yellow coloration. The lighter-colored young are born with the full complement of 21 legs posessed by the adults, and have been found still associated with the mother in a nest under a rotted log for some time after birth. The eyes of centipedes consist of four ocelli on each side of the head, and they posess four pairs of jaws, one pair of which is modified into poison fangs. Their food consists of nocturnal animals, and sometimes one will see the elytra of May beetles discarded at the entrance of their hole in the ground. Their bite is painful and dangerous to man directly in proportion to the size of the centipede inflicting it, but is not fatal.

MILLIPEDES

Of the twenty or more species and subspecies of millipedes (Class Diplopoda) reported from Puerto Rico, the one of possibly greatest interest is a large reddish-brown arboreal species, the stomach of which Dr. R. T. Cotton ("Scale Feeding Habits of a Porto Rican Millipede, *Rhinocritus arboreus* (Saussure)" Jour. Dept. Agr. P. R., **1** (3): 175–6. San Juan, July 1917) found filled with the bodies of the purple scale of citrus, *Lepidosaphes beckii* Newman. In experimenting with these animals, he "placed about a dozen on several small grapefruit trees heavily infested with purple scale. At the end of two weeks the trees were perfectly clean and free of scales, and the bark took on a fresh green color." The normal food of most millipedes is decaying vegetable matter, and that one species should have adopted scale insects, at least in part, is of the greatest biologic interest, as well as of economic value. Two subspecies of *arboreus* occur in Puerto Rico: *gundlachi* Karsch, "which is lilac-colored, with a dorsal median red stripe", and *krugii* Karsch. The former has recently been noted on maga trees heavily infested with the pustule scale, *Asterolecanium pustulans* Cockerell, but at least in captivity they did not feed on the scales.

The formerly most common millipede, *Trigoniulus lumbricinus* (Gerstaecker), a somewhat smaller reddish-brown terrestrial species, feeds on decaying vegetation, and occurred in enormous numbers in malojillo meadows from which the hay was not cut as rapidly as it matured. Structures of concrete have a peculiar attraction to millipedes in rainy weather, and even constant sweeping of the concrete porches of houses out in the country did not serve to free them of its obstinate persistence. The introduction of the giant Surinam toad, *Bufo marinus* (L.), into Puerto Rico greatly reduced the abundance of this millipede, for the toad is not fussy as to its food, and the millipede moves just fast enough to

attract attention, but too slowly to escape. At the present time, one must really search to find many, the most likely place being a pile of cachaza that has been undisturbed for a few days.

Another millipede, mostly black in color, but with the edges of its dorsal plates prolonged laterally on each side to form conspicuous yellowish wings, is often found in dead seed cane pieces. Actually it is not responsible for the death of the seed piece, but the dead cane merely furnishes a favorable environment for the millipede. It has been identified as *Orthomorpha coarctata* (Saussure) by Mr. H. F. Loomis of Coconut Grove, Florida. It occurs in practically all of the West Indies, from Cuba to Trinidad. In Puerto Rico it forms an item in the food of the toad, and also of the introduced bullfrog, *Rana catesbiana* Shaw.

The Scale-Eating millipede, *Rhinocritus arboreus* (Saussure), one-half natural size· (Drawn by Fritz Maximilien).

The only extensive systematic discussion of these animals is by Dr. R. V. Chamberlin: "The Chilopoda and Diplopoda of the West Indies" (Bull. Mus. Comp. Zoology, **42** (5): 151–262. Cambridge, July 1918).

ARACHNIDA: Scorpionida

The common dull yellow, spotted scorpion most often seen in houses, sheds and garages in coastal Puerto Rico is *Isometrus maculatus* DeGeer, as identified by Prof. Nathan Banks. Sometimes much smaller and somewhat greenish young are found with their mother, to the number of half a dozen or less.

The plumper, reddish-brown scorpion found in the mountains is *Tityrus obtusus* Karsch.

On Mona Island, neither of these has been collected, but scorpions in general are much more abundant, being found under bark of trees and in dead logs. Prof. Banks identifies them as *Diplocentrus* sp. and *Centrurus* sp., possibly *nitidus* Thorell.

ARACHNIDA: Pedipalpida

On the walls of the caves at Aguas Buenas, Dr. Roman Kenk collected many enormous tailless scorpions, *Phrynus palmatus* (Herbst) (= *Tarantula reniformis* F., as identified by Prof. Banks). The body of even the largest of these "guabás" is not much more than an inch in length, but individual segments of their eight legs are longer than this, so that when its legs are spread out normally, the animal covers much space. In color it

is mostly reddish-brown, but the non-chitinized joints of its legs and palpi are strikingly white and conspicuous. Its palpi are strong and powerful, and are armed with numerous sharp spines, both long and short. Nothing is definitely known of its food habits, but Dr. Kenk thinks they are predaceous on cave crickets and other insects.

ARACHNIDA: Pseudoscorpionida

The false scorpions have no tail, but prominent chelate mandibles so large as to dwarf the remainder of the animal. The local forms are small to minute, usually reddish-brown in color, and are found under bark or in decaying vegetation.

ARACHNIDA: Araneida

The most extensive information concerning the nearly two hundred spiders (Arachnida: Araneida) recorded from Puerto Rico is most fortunately available because Dr. Alexander Petrunkevitch, a recognized authority on this class of animals, and Professor of Zoology at Yale University, was exchange professor at the University of Puerto Rico in 1925. His publication on "The Spiders of Porto Rico" (Transactions of the Connecticut Academy of Arts and Science, **30** (1): 1–158, fig. 150. January 1929; **30** (2): 159–355, fig. 240. January 1930 and **31** (3): 1–191, fig. 168, December 1930, New Haven) is quoted in the following accounts of a few of the more common and obvious spiders.

Miss Elizabeth B. Bryant has made "Additions to the Spider Fauna of Puerto Rico" (Jour. Agr. Univ. P. R. **26** (1): 1–19, pl. 2. Rio Piedras, May 1942), describing eleven new species from El Yunque and the Maricao Forest, collected by Dr. P. J. Darlington, and in "Notes on Spiders from Puerto Rico" (Psyche, **54** (3): 183–193, pl. 1. Cambridge, September 1947) describes four more, collected by Mr. Harry Beatty on El Yunque, and lists "three others that have never been reported from the island before". In "A List of Spiders from Mona Island, with Descriptions of New and Little Known Species" (Psyche, **54** (2): 86–99, pl. 1. Cambridge, June 1947), she describes four new species, including *Wixia serrallesi*, collected by Mr. Jorge J. Serrallés.

The common tarantula of Puerto Rico, *Cyrtopholis portoricae* Chamberlin, velvety black or dark brown except at the prominent whitish naked joints of the legs, is by no means so large and formidable as the hairy, spiny species of the larger islands and on the mainland. It is "found in large numbers thruout the Island up to an elevation of about 2,000 feet, but is most common in the low regions. It makes holes in the ground, varying in diameter and depth. One sees these holes in great numbers in gardens on bare soil, on lawns and meadows, in embankments along roads and in

the limestone hills along the northern coast. Large holes inhabited by adult individuals are one, to one and a half inch in diameter, without any web across. Neither is the burrow itself lined with silk. It is cylindrical, and about half way from the entrance becomes rapidly smaller, its diameter corresponding now to the diameter of the spider's abdomen. Most of the burrows are about one foot deep, usually not vertical, but inclined and often with a bend. At the mouth of the burrow one may commonly see remains of large millipeds constituting the chief food of these spiders. Both males and females make and live in burrows where they may be found at any time of year. But in midwinter, *i.e.* in December and January, one meets also males walking on the ground or climbing on the walls of buildings, presumably in search of females. Both sexes are very gamy, always ready to fight when in danger, the males even more so than the females." The only serious enemy of *Cyrtopholis portoricae* is *Pepsis marginata* PB, a large blue-black wasp with orange wings, the largest of its genus occurring in Puerto Rico, which attacks the spider and uses its limp body for food for its own larvae. Dr. Petrunkevitch's "Tarantula versus Tarantula-Hawk: a Study in Instinct" (Jour. Expt. Zool., **45** (2): 367–393, pl. 2. 1926) describes the fight between wasp and spider under cage conditions.

The infamous black widow spider, *Latrodectus mactans* (F.), the range of which is from the southern United States to Patagonia, including the West Indies, is "easily found in Puerto Rico, but by no means as common as in tropical Mexico". "The female is quite easy of identification, being the only spider of from 10 to 12 mm. in length (just under half an inch), with an almost globular abdomen of a shiny black, with a brilliantly red spot on its vetral surface, shaped like an hour-glass or a square; with black carapace and legs. The male is considerably smaller, and invariably shows the oblique red stripes of the youthful female."

"The species lives in webs which it spins either in crevices of rocks, or in hollows of trees, on some shrubs and cacti, in bamboo fences, in dark corners of buildings and on walls. The female has the habit of hanging in her web with her legs up and her back toward the ground. Occasionally she protects the entrance to the web by means of a tough membrane with a central circular opening. She makes from two to several egg-shaped, pointed, rather smooth, buff-colored cocoons which she suspends with threads in her web, and guards until the spiderlings emerge. Her food consists chiefly of large insects such as junebugs, grasshoppers, cockroaches, etc. For this reason and notwithstanding its poisonous qualities, the species must be regarded as being truly beneficial. The male is too small to bite through human skin and may be handled with impunity. The female, when disturbed, prefers to escape by running and rarely bites even

if taken in one's hand. She never attacks man of her own volition or on her own initiative. The only places where the spider may be really dangerous are the toilets, especially, of course, the old-fashioned out-houses. Here the female builds her web occasionally across the opening of the seat, encouraged to do so by the presence of numerous insects which in their turn are attracted by the odor of the excrement. In other countries cases are on record of men having been bitten on the genitals in the toilet, naturally with very grave consequences, for the effect of the poison is not local, but constitutional, comparable to that of the rattlesnake."

The bite of *Latrodectus geometricus* (C. Koch), greyish brown in color with black and white markings on the abdomen, "has also been found to be poisonous, altho its poison is less virulent".

One of the most striking of the smaller spiders of Puerto Rico is *Theridula opentula* (Walcknear), shining black in color, with bright yellow spots on the abdomen, and lateral and terminal humps that tend to become horns. A cosmopolitan species, "in Puerto Rico it is very common, found in small reticular webs on the leaves of various plants," and occurring from coastal cane fields to the top of El Yunque. It is of more particular importance to the cane grower because it appears to be a predator on the yellow aphid of sugar-cane, *Sipha flava* Forbes, even if it is too small and too scarce to be of much value in reducing really heavy infestations of the aphids.

The broad, white, enameled abdomen of *Gasteracantha cancriformis* (L.) has two prominent reddish horns on each side and two to the rear, suggestive of its specific name meaning "crab-shaped". It is a common neotropical species, but of widely varying abundance in Puerto Rico. Dr. Petrunkevitch collected no specimens here, but recent collections have been made at Guánica and near Mayagüez, and twenty years ago it was very abundant in the coconut grove near what is now the residence suburb of San Juan known as Punta Las Marías. Its egg-clusters, covered with a matting of light green silk, abounded in the cracks and crevices of old stems of bougainvillea vines, and of wooden houses. Few spiders emerged, however, as a Chloropid (Oscinid) fly, *Pseudogaurax lancifer* Coquillet, had parasitized most of them. It is quite possible that this parasite, endemic in Puerto Rico, may be responsible for the great variations here in the abundance of this quaint spider.

The abdomen of the more typical West Indian species, *Gasteracantha tetracantha* (L.), has only a single lateral horn on each side, but two behind. It is not found on the mainland, but occurs here in coastal coconut groves as well as high in the mountains.

With bodies and legs as elongate as the cane leaves on which one so often finds them, with the front legs close together in front and the abdomen and hind legs together stretched out in the rear, paralleling the mid-

rib of the cane leaf, rests the fragile, light brown *Tetragnatha pallescens* Cambridge, common in Puerto Rico from the coast to the top of El Yunque. During the daytime at least, one rarely sees these studies in elongation do anything but rest; they have no nest, not even scattered strands in which their presumed insect food might become entangled.

Metepeira labyrinthea (Hentz) "is a Pan-American spider distributed from Labrador to Patagonia. It is very common in Puerto Rico on fences, telegraph and telephone wires, plants, etc, and is found at all altitudes."

The huntsman spider, *Heteropoda venatoria* (L.) "is a cosmopolitan species found in all tropical and subtropical regions of the globe, and is quite common in the West Indies. The spider is very common in Puerto Rico, from the coast to the highest altitudes, wherever there are human habitations. It is one of the largest spiders of nocturnal habits, spending the day in cracks in wood, behind furniture, pictures and other objects, in cupboards, under stairways, and hunting during the night for insects, chiefly cockroaches. Nobody is afraid of the Huntsman Spider in the tropics." The peón calls it "araña boba", that any spider looking so ferocious should be so foolish as not to bite. "The cocoon is flat and the female carries it under her sternum. The male is somewhat smaller and has relatively longer legs." One sometimes finds an entire shed skin of this spider, with the legs expanded and perfect, but the abdomen shriveled, the hard carapace empty but unshrunken.

Selenops insularis Keyserling is the common large mottled brown and very much flattened spider "pre-eminently adapted to life under loose bark or between bases of the leaves of such plants as Bromelia, pineapple, Pandanus, various palms, etc. Here they hide, living on insects, and if disturbed, run with amazing swiftness to the nearest crack or crevice. The females make flat cocoons containing the eggs, which they guard."

Of the jumping Attid spiders, which construct no nest, the one most common is the cosmopolitan *Plexippus paykulli* (Audouin), which is "the largest jumping spider found in Puerto Rico, and is distributed throughout the Island." At higher elevations, especially in coffee groves, the common species is *Corythalia* (*Prostheclina*) *signata* (Banks), conspicuous with its irridescent blue-green markings and constantly vibrating palpi. During wet weather, it is attacked and killed by a fungus, *Gibellula arachnophila* Sacc., and its dead body will be seen stuck to a coffee leaf by the hyphal strands of the fungus.

Besides this fungus, the tarantula-hawks and the Chloropid fly parasitic on the egg-clusters of *Gasteracantha*, another enemy of many spiders is the large yellow and black wasp, *Tromatobia cressoni* (Dewitz), which has repeatedly been reared from egg-clusters of various large spiders. The

tarantula-hawk attacks and paralyzes a single tarantula at a time, and when burying the parasitized tarantula in hard-packed ground, lays a single egg upon the abdomen of the spider. The mud-wasp, *Sceliphron caementarium* Drury, first builds her mud nest, all but the final seal, and then catches and stings, one by one, numerous small spiders which she brings to fill the nest, lays her egg and seals them all in with a final daub of mud. In both cases, the sting of the wasp merely paralyzes the spider, which remains alive but inactive: a supply of fresh food for the larva of the wasp sufficient in amount for its complete development to adult. The adult tarantula-hawk weighs only an eighth as much as does the tarantula, comparable to the ratio between the weight of the little spiders assembled in a single cell of its nest by *Sceliphron*, and its own weight. Against the wasps specifically attacking them, spiders neither make, nor attempt any defense except that of hiding or running away. And against the insects parasitizing egg-masses, there is no protection. Thus are revenged the insects caught by jumping spiders, or in the sticky silken webs of others from which every attempt to escape only entangles them the more securely.

TICKS

Ticks (Ixodoidea) and mites (Acarina), which are the most abundant members of the order Acarida, class Arachnida, differ most obviously from spiders in having an unsegmented body with the abdomen broadly joined to the cephalothorax, but like the spiders, most of them have eight legs when adult. To be sure, seed-ticks have but six legs, and might easily be mistaken for insects, but they moult to eight-legged nymphs, which in turn become eight-legged adults. The larval ticks (seed-ticks), the nymphs and the adults are all parasitic on higher animals, but not necessarily warm-blooded animals. *Amblyomma cruciferum* Neumann has been found on the large iguana lizard, *Cyclura stejnegeri* B. & N., on Mona Island (H. Douglas Tate, "Biology of the tropical cattle tick and other species of ticks in Puerto Rico, with notes on the effects on ticks of arsenical dips" Jour. Agr. Univ. P. R., **25** (1): 1–24, ref. 3. Río Piedras, July 15, 1941). The first giant Surinam toads, *Bufo marinus* (L.), brought to Puerto Rico from Jamaica, were found infested with the tick *Amblyomma dissimile* Koch. The ticks were removed from between the eyes (the only place on the toad's body which it is unable to reach and scrape them off), so that *Bufo* in Puerto Rico is relieved of the incubus of one enemy attacking it on the mainland, as well as in some islands where it was introduced.

The common cattle tick, *Boöphilus* (*Margaropus*) *annulatus microplus* (Can.), is injurious not only because of the direct loss of blood, but also because a serious disease of cattle, Texas fever, is transmitted by these

ticks. The transmission is not direct, as is malaria by mosquitoes, but fully-engorged female ticks falling from cattle which have had the fever when young and have thus become immune, lay eggs from which hatch seed-ticks that transmit the disease to the first animal from which they suck blood. Cattlemen in the northern United States noted that when Texas longhorns were driven to market along roads beside their farms, this was almost invariably followed by an outbreak of what came to be called "Texas fever" in their animals. The tick can not withstand the cold of northern winters, thus northern cattle do not acquire immunity to the fever by being infested with infected ticks while young. Following the proof of the role of the tick in causing Texas fever, campaigns to eliminate the tick in the southern United States were initiated, so that at the present time only in the wildest regions, where the presence of deer and other wild animals complicates the problem, does the tick still exist.

In Puerto Rico, all so-called "native cattle", descended from those imported from Spain or elsewhere, have acquired immunity, but dairy cattle of improved breeds, imported from parts of the United States where there are no ticks, suffer heavy mortality when brought here as adults. Thus a similar campaign to eliminate the cattle tick in Puerto Rico was initiated some time ago, and at the present time the continued existence of the cattle tick is possible only where the clean-up has not been entirely effective. Because the principal importation of cattle for slaughter in Puerto Rico is from the Virgin Islands, a similar clean-up campaign was also started there, the results of which tend to be ineffective because of the presence of wild deer in the cactus scrub of northern St. Croix.

Cattle ticks may also develop on susceptible individual sheep, goats, horses and very rarely on dogs, but not on any other wild or domestic animals present in Puerto Rico. Naturally, all of these animals likely to harbor cattle ticks must be dipped in the arsenical vat at the same time and as many times as are the cattle if the eradication is to be perfect.

The ears of horses often, and more rarely other parts of their bodies, and of mules in Puerto Rico, are infested with the so-called tropical horse tick, *Dermacentor nitens* Neumann. In many ways this is similar to the cattle tick, and is killed by immersion in the arsenical dip, if this reaches all parts of the skin of the infested horse or mule.

The so-called brown dog tick, *Rhipicephalus sanguineus* Latreille, occurs on dogs of all colors in Puerto Rico, but is somewhat harder to see on those that are brown in color. Stray dogs often escape constant re-infestation by this tick, as house dogs do not, because the fully-engorged females tend to drop off at night where the dog sleeps, and not to wander far before laying eggs. The minute seed-ticks are inconspicuous until they become engorged, when on the white patches of a dog they produce a speckled

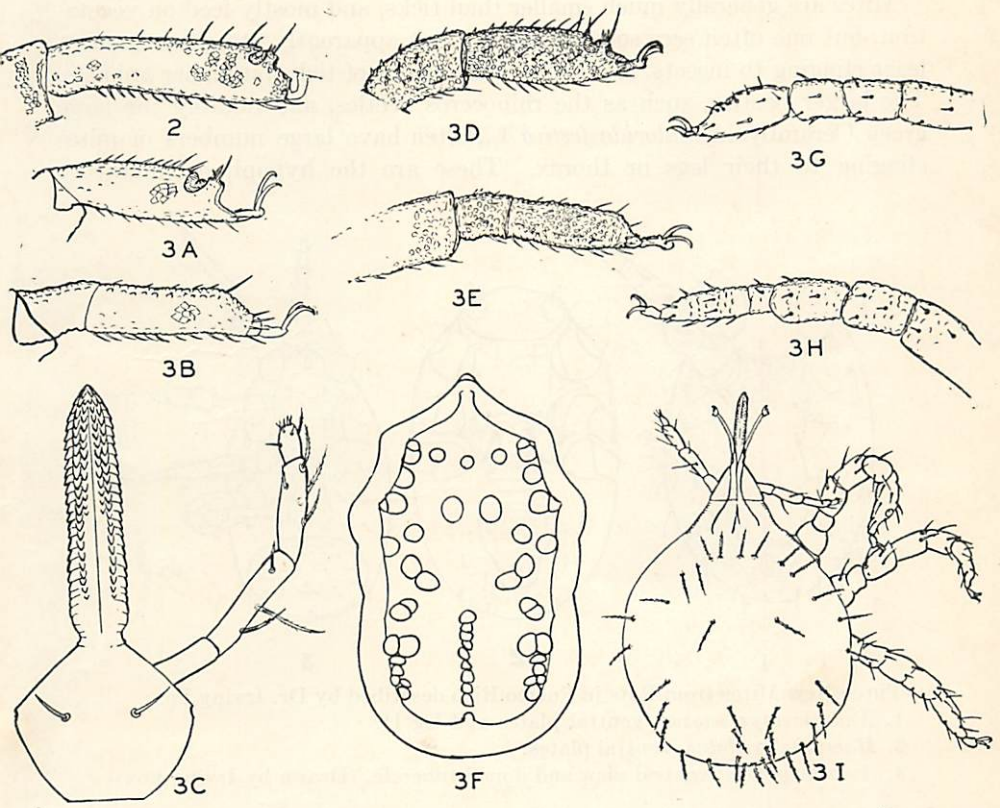
appearance. Of course it is possible to destroy these ticks by dipping a dog in a cattle dipping vat, and these are often readily available in Puerto Rico, but sometimes that is not practical. As an alternative, hand-picking must be adopted: on the dog before the ticks become of full size, and after the adults fall off in the area inhabited by the dog, and especially where it sleeps. A liberal application of derris powder will kill most of the small ticks, and bathing in diluted cresol, or with "dog soap" is also of value.

What looks like little black flies that one sometimes sees crawling between the hairs of tick-infested dogs are really parasitic wasps, which attack the nymphal dog ticks. Named by Dr. L. O. Howard after its discoverers, Drs. W. D. Hunter and W. A. Hooker, *Hunterellus hookeri* is sometimes so abundant as to be a very effective parasite. Ordinarily, seven to ten wasps develop to maturity in a single fully-grown nymphal tick. Temporarily, it may destroy most of the dog ticks in limited regions, but experiments in introducing it into regions where it does not normally occur have been disappointingly fruitless.

"*Ornithodorus puertoricensis*, a New Tick from Rats in Puerto Rico" (Journal of Parasitology, **33** (3): 253–9, fig. 3, ref. 22. Baltimore, June 1947) was described by Dr. Irving Fox, who found approximately a quarter of the rats in the metropolitan area infested with larvae of this tick on the back or sides. "Feeding of the nymphs and adults on rats is accomplished in 20 to 40 minutes; the nymphal stages are capable of existing for long periods without feeding at all, as a number have been kept in vials for more than 8 months. It may be assumed that the nymphs and adults remain hidden in the nests and other places frequented by rats. They are not known to attack man in Puerto Rico". Dr. Irving Fox records "The Occurrence of a Rare Genus of Ticks on Bats in Puerto Rico (Acarina: Spelaeorhynchidae)" (Jour. Agr. Univ. P. R., **26** (4): 95–7, ref. 10. Río Piedras, March 29, 1943), tentatively identified by Dr. H. E. Ewing as *Spelaeorhynchus latus* Banks, and Prof. Banks is himself responsible for the questionable record of *Antricola marginatus* (Banks) from a West Indian bat, probably from Puerto Rico.

Chickens from the dryer portions of Hispaniola, and the crates in which they are brought to Puerto Rico, are often infested with the fowl tick, *Argas miniatus* Koch (= *Argas persicus* (Oken)). This tick has been known from Port-au-Prince since 1927 (see "Entomologie d'Haiti", page 409) and possibly has been present in Hispaniola for a long time previously. Moreover, it is probable that it had already become established at Guánica and Ponce from importations from Santo Domingo before careful inspections had begun on the crates and their contents. The habits of the fowl

tick resemble those of bedbugs, the flattened leathery females being able to live for a long time in cracks of an uninhabited chicken-coop. When a host is present, they come out of hiding as soon as darkness hides them from the unsuspecting chicken, and by morning are fully-engorged with its



Ticks from Rats:

2. Tarsus I of adult of *Ornithodorus talaje* (Guérin-Méneville) from Mexico.

3. *Ornithodorus puertoricensis* Fox from Puerto Rico:

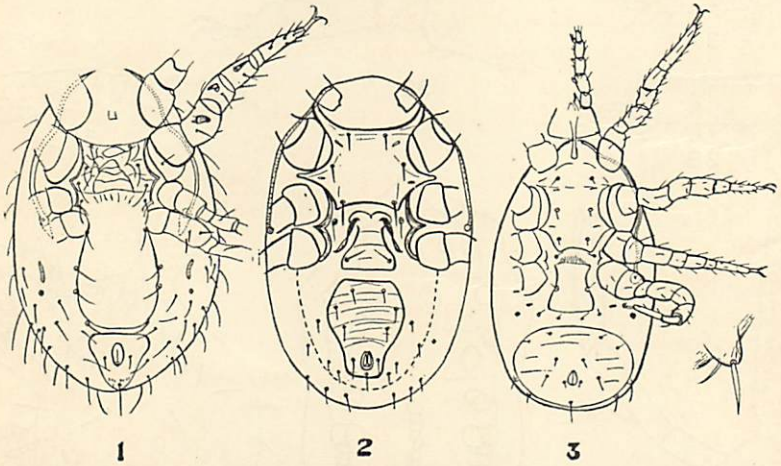
3A. Tarsus I of female, 3B, Tarsus IV of female, 3C, Capitulum of larva, 3D, Tarsus I of fourth nymph, 3E, Tarsus IV of fourth nymph, 3F, female shape and pattern of disc, 3G, Tarsus I of first nymph, 3H, Tarsus IV of first nymph, 3I, larva, dorsal view. (Drawn by Irving Fox).

blood. They do not remain on the host as adults, and before daylight are safely hidden in a crack, where they remain until after they have laid their eggs. This may be repeated several times. Both larval and nymphal ticks hide in cracks while moulting, but it takes them longer than over-

night in which to become fully-engorged, thus they may be found on infested hosts even in the daytime.

MITES

Mites are generally much smaller than ticks, and mostly feed on vegetation, but one often sees some kinds of mites apparently attached to, or at least clinging to insects, like heavy infestations of ticks on higher animals. The larger beetles, such as the rhinoceros beetles, and notably the large green Cerambycid, *Chlorida festiva* L., often have large numbers of mites clinging to their legs or thorax. These are the hypopi, or migratory



Three New Mites from Rats in Puerto Rico described by Dr. Irving Fox:
1. *Androlaelaps setosus*, ventral plates and leg II.
2. *Macrocheles alatus*, ventral plates.
3. *Asca duosetosa*, ventral view and dorsal tubercle. (Drawn by Irving Fox)

nymphs of various species of *Tyroglyphus* (the only one determined to species being *Tyroglyphus heteromorphus* Felt on *Strataegus* grubs), or *Trichotarsus*, *Gamasus* or *Hologamasus*, merely catching a ride on their insect host, and not sucking blood from the insect. Even termite nymphs have been observed with mites clinging to them, but eventually the mites discovered the termites didn't go anywhere, or only in circles, and moved off under their own leg power. The adults of these mites attack grain, cheese and mushrooms, and are sometimes serious pests. In his studies on white grubs, however, Mr. E. G. Smyth noted that when a female rhinoceros bettle laid her eggs, some of the mites dropped off her body and began feeding on the eggs, a single minute mite emptying the egg-shell of its contents and attaining enormous size. These mites were never identified,

altho presumably they were some of the above that have modified their habits under tropical conditions.

"The American mushroom mite (*Tyrophagus* (formerly *Tyroglyphes*) *lintneri* (Obs.)) is sometimes troublesome" in the conditioning or storing of vanilla beans, according to Dr. Norman F. Childers and Mr. Héctor R. Cibes, in their account of "Vanilla Culture in Puerto Rico" (Circular No. 28, Federal Experiment Station, Mayagüez, pp. 94, fig. 58, ref. 27 and many additional ref., Washington, D. C., June 1948), imparting a bad odor to the beans. "In cases of limited infestation, they can be treated with alcohol or sunning. Mites can be controlled by fumigating the curing and conditioning equipment and the entire room with sulfur."

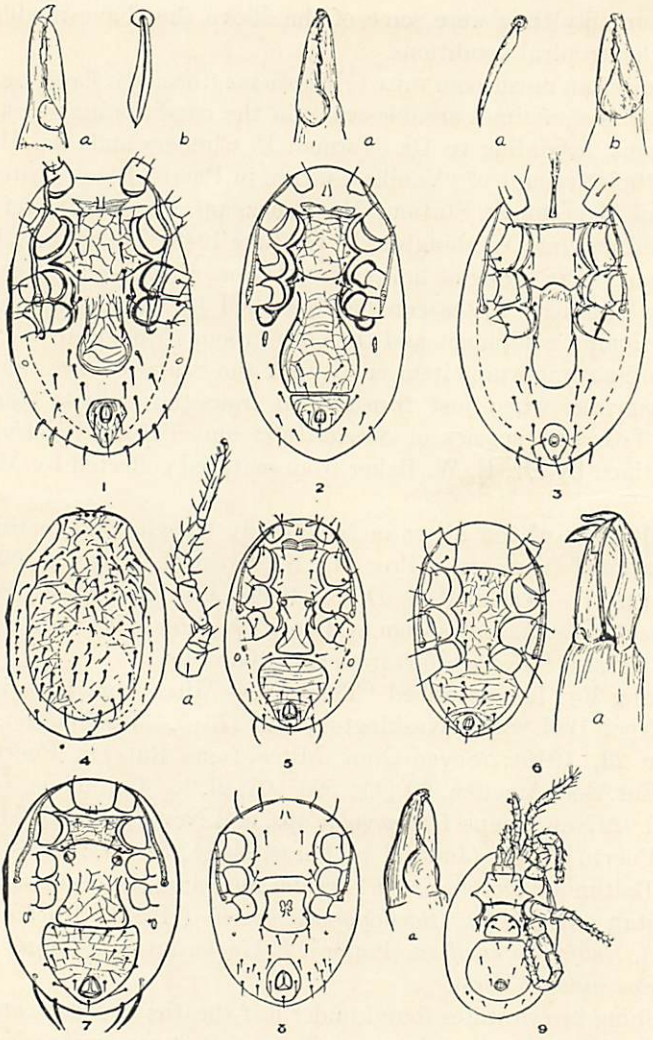
Mites are an important item of food for the "zapitos" or minute toads of *Bufo marinus* when just transformed from the tadpole stage: *Asca duosetosa* Fox, and species of *Scheloribates* and *Tyhypochthonius* having been identified by Dr. E. W. Baker from material collected by Mr. Mario Pérez.

In "A Review of the Mites of the Family Cheyletidae in the United States National Museum" (Proc. U. S. National Museum, **99** (3238): 267–320, pl. 17. Washington, D. C., 1949), Dr. Edward W. Baker describes *Cheyletus malaccensis* from St. Croix, *Cheyletia wellsi* from sugar-cane at Mayagüez and *Eutogenes foxi* from rat at Gurabo.

Dr. Irving Fox has described "Three New Mites from Rats in Puerto Rico" (Proc. Biol. Soc. Washington, **59**: 173–5. Washington, D. C., December 23, 1946); "Seven New Mites from Rats in Puerto Rico" (Annals Ent. Soc. America, **40** (4): 598–603, pl. 1. Columbus, December 1947) and "A New Genus *Borinquolaelaps*, and New Species of Mites from Rats in Puerto Rico" (Journal of Parasitology, **32** (5): 445–452, pl. 1, ref. 11. Baltimore, October 1946) besides recording the occurrence of such cosmopolitan species as *Bdellonyssus bacoti* (Hirst) *Myobia musculi* (Schrank), *Radfordia ensifera* (Poppe), *Echinolaelaps echidninus* (Berlese) and *Laelaps nuttalli* Hirst.

The shining brown mites found under leaf-sheaths of sugar-cane feeding on debris and excrement of the caterpillars of *Diatraea saccharalis* F., have been identified as *Damaeus nitens;* those in rotten cane stalks as *Liacarus;* those under bark of decaying trees as *Uropoda;* and on gramma grass and on bark of living trees, very quaint dull brown mites with concentrically ringed abdomens are *Neoliodes concentricus.* The indefinite character of the information about these mites indicates how little they have been studied, either here or elsewhere.

In the imported hay brought to Camp Las Casas at Martín Peña during World War I was white clover seed that started growing in the roads after the camp had been abandoned, and in cane fields nearby the underside of



New Species of Mites from Puerto Rico described by Dr. Irving Fox:

1. *Cosmolaelaps gurabensis* female, ventral view of body; *a*, chelicera; *b*, dorsal seta.
2. *Mysolaelaps stigmatus* female, ventral view of body; *a*, chelicera.
3. *Ischnolaelaps alexandrini* female, ventral view of body; *a*, dorsal seta; *b*, chelicera.
4. *Borinquolaelaps dentatus* female, dorsal view of body; *a*, Leg I.
5. *Borinquolaelaps dentatus* female, ventral view of body.
6. *Ischnolaelaps alexandrini* male, ventral view of body; *a*, chelicera.
7. *Borinquolaelaps coronatus* female, ventral view of body.
8. *Borinquolaelaps mariposus* female, ventral view of body.
9. *Macrocheles fonsecai* female, ventral view of body and legs of one side; *a*, chelicera. (Drawn by Irving Fox)

the leaves of young plant cane was found infested with little green mites that caused injury looking much like that produced by the yellow aphid. This was the first record of *Paratetranychus viridis* Banks in Puerto Rico; a few months later to be found at Patillas, Trujillo Alto and Barceloneta. Subsequently, this mite, which attacks many economic crops in the southern United States, disappeared quite as completely as did the struggling plants of white clover, and neither has been found here since. Quite recently, however, another green mite attacking the underside of the leaves of sugar-cane, but causing no reddening, merely a blotching simulating mosaic disease, has become quite abundant on the north coast, notably on the new variety Mayagüez 28. It proved to be new, and was described by Mr. E. A. McGregor as *Paratetranychus sacchari* ("A New Spinning Mite attacking Sugar Cane in Puerto Rico" Jour. Agr. Univ. P. R., **26** (4): 91–94, pl. 1. Rio Piedras, March 29, 1943).

Other local species are *Tetranychus quinquenychus* found on leaves of garden pea, *Tetranychus telarius* (L.), on alfalfa, and the red spider of cotton, *Tetranychus bimaculatus* Harvey, sometimes found on the underside of cotton leaves during exceptionally dry weather, but rarely in Puerto Rico a serious pest.

Very different in appearance and habits from these red or green "red spiders" are the Tarsonemid mites (H. E. Ewing "A Revision of the Subfamily Tarsoneminae of North America, the West Indies and the Hawaiian Islands" Technical Bull. No. 653, U. S. Dept. Agr., pp 64, fig. 25, ref. 35. Washington, D. C., January 1939), which have the two pairs of front legs far distant from the two rear pairs. Practically every stalk of sugar-cane harvested in Puerto Rico shows the former presence of *Tarsonemus bancrofti* Michael (= *spinipes* Hirst) as a rusetting or roughening of the rind, the pattern of which is often characteristic of the variety of cane, and indeed has often been included in its description. This mite, first described from Barbados, now occurs nearly everywhere that sugar-cane is grown, having usually been spread on introduced varieties. Live mites are to be found only on the young shoot under the leaf-sheaths, minute and whitish, each in a separate crater or depression in the tender rind. As the cane ages, the live mites disappear, but the multitude of coalescing craters, becoming darker, eventually forms the russeting present on every joint of the cane. The injury to the cane is negligible, and growers never realize the presence of this mite unless they have been in some isolated region, like the Tambo Valley, Perú, where the mite has been accidentally introduced recently, and the difference in appearance of the cane is then apparent.

Under the base of the closely appressed leaves of the pineapple one also sees a somewhat similar injury caused by *Tarsonemus ananas* Tryon, first described from Queensland, later noted in Hawaii, and since found every-

where that Smooth Cayenne pineapples are grown. The actual injury is negligible.

Much more serious is the injury caused by *Hemitarsonemus latus*, described by Prof. Nathan Banks from mangoes grown in a greenhouse at Washington. Mangoes may have been the original host, but if so, the mite has greatly widened its host range, and in St. Croix and more recently in Puerto Rico it has become a very serious pest of peppers. "When they are attacked by it, the leaves of pepper assume a dwarfed, deformed, wrinkled, warty and scabby appearance, and the young terminal shoots show an excessive multiple bud formation", to quote from Mr. Charles E. Wilson, Entomologist of the Virgin Islands some twenty years ago. Lighter infestations cause a mottling of the pepper leaves simulating mosaic disease, and even such comparatively light infestations greatly reduce the crop produced. These mites are more abundant during dry weather, but they have now come to be an almost omnipresent pest in Puerto Rico. Control is by spraying with lime-sulfur, which must be constantly repeated thruout the cropping season if the pest is to be merely kept under control, for its elimination now seems impossible.

Crumpled or deformed leaves, or irregular warty excressences on the leaves or other parts of the cotton plant are caused by a blister mite, *Eriophyes gossypii* Banks. The gall produced by this mite is much larger than the animal itself, for the fully-grown mites are microscopic in size, being less than a hundredth of an inch in length. Even with a powerful lens one can with difficulty distinguish them among the numerous hypertrophied plant hairs which line the cavities inside the warts which their presence has caused, and within which they live. Gall-making mites have but four legs, a pair each side, and are not even spider-like in appearance, or tick-like in shape, being elongate and cylindrical. Sometimes the galls caused by these mites occur on young cotton plants, but ordinarily only the older plants are infested to any extent. Indeed, the infestations spread but slowly, and by picking off infested leaves, or by destroying the entire plant, any further extension can be prevented in the field. The wild Marie Galante cotton appears to be immune to infestation, but the Barbadense wild cotton is very susceptible, and the mite is carried over the dead season for Sea Island cotton on this wild host. Naturally, such old trees of wild cotton should be destroyed, quite as much to eliminate pink bollworm as to control blister mite. Indeed, the occurrence of blister mite in a field of Sea Island is the clearest indication of the imperfect character of the wild cotton clean-up: a premonition of the damage due to pink bollworm sure to appear later.

The "verruga" or warts caused by the cotton blister mite are more extreme, but not different in character from those caused by other species of these mites on their respective hosts: *Eriophyes guazumae* Cook on guacima leaves, *Eriophyes miconiae* Cook on the leaves of the local species of *Miconia* known as "camasey", *Eriophyes cordiae* Cook on the leaves of some species of *Cordia*, and *Eriophyes calophylli* Cook causing the hairy brown areas on the underside of the distorted leaves of "María" (*Calophyllum antillanum*).

The scab or itch mites are parasitic on higher animals. They are minute, whitish, hemispherical in shape, with the front pairs of legs widely distant from the rear pairs. The females burrow into the skin, and the young hatching from their eggs make other burrows, causing a diseased condition called scabies or mange. The dog mange mite, *Sarcoptes scabei canis* Gerlach, may attack man as well as dogs. Bathing in much diluted carbolic acid (cresol) is usually effective in control. Dr. W. F. Wooldridge has shown that an ointment containing "The Gamma Isomer of Hexachlorcyclohexane in the Treatment of Scabies" (Jour. Investigative Dermatology, **10** (5): May 1948) is very effective. A similar mite attacking rabbits, *Psoroptes cuniculi* (Delafond), especially on the ears, is sometimes so seriously abundant as to cause the death of the host, and is always a constant liability. Dr. H. L. Van Volkenberg in "An Annotated Check List of the Parasites of Animals in Puerto Rico" (Circular No. 22, P. R. Expt. Station, pp. 12, ref. 49. Washington, D. C., January 1939) lists a dozen or more others: *Otodectes cynotis* Hering: the ear mite of the dog and cat—unimportant; *Notoedres cati* (Hering): the head mange mite of the cat—common; *Psoroptes bovis* (Gerlach): the scab mite of cattle—infrequent; *Psoroptes equi* (Hering): the psoroptes mange of the horse—common, especially in the southern coastal plain and mountain regions; *Sarcoptes equi* Gerlach: the equine sarcoptic mange mite—rare in the horse; *Sarcoptes suis* Gerlach: the sarcoptic mange mite of swine—the mite is common, but the mange is unimportant; *Desmodex canis* Leydig; the dog follicle mite—apparently rare in dog; *Desmodex phylloides* Csokar: the swine follicle mite, frequently encountered in slaughtered hogs, but the mange is unimportant; *Desmodex bovis* Stiles: apparently rare in cattle; *Liponyssus bursa* (Berlese): the tropical fowl mite, common; *Cytoleichus nudus* (Vizioli): the air sac mite; *Trombicula tropica* Ewing: the tropical harvest mite, of which the larvae are frequently found on the horse, less often on goat and chicken; *Megninia cubitalis* Megnin and a species of *Epidermoptes:* feather mites, apparently common on the chicken; all of these mites having been determined by Dr. H. E. Ewing.

INSECTA

THYSANURA: Silverfish

The very simplest and most primitive of insects are neither microscopic in size nor so rare that only the specialist ever sees them. The big, fat, inch-long (if one includes antennae and the three long appendages at the hind end of the body) silverfish (Thysanura) that one almost invariably finds on disturbing old books and papers, especially old fiber-board shipping cases, are representative of the oldest insects in the world. The cosmopolitan **Lepisma saccharina** L. is the large, silvery-grey species common in Puerto Rico. Dr. J. W. Folsom, a specialist in this order of insects, described as new the local blue-grey **Ctenolepisma reducta,** the type of which was collected in the envelopes holding the scale insect collection of the Experiment Station at Río Piedras ("A New Lepismid from Puerto Rico" Proc. Ent. Soc. Washington, **25** (7–8): 169–170, fig. 8. Washington, D. C., October–November 1923). It also occurs in decrepid polilla-eaten furniture, but not in the tunnels occupied by living termites.

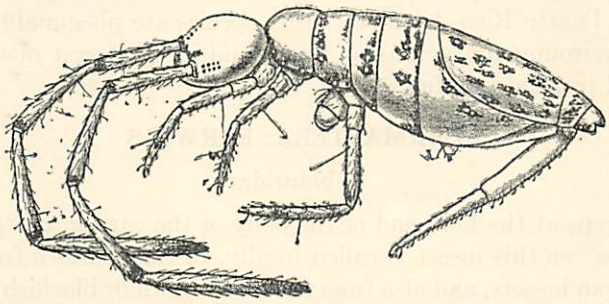
The female silverfish lays white, spherical eggs, from which the hatching young appear as minute replicas of their parents. Nobody has reared them to adult in the tropics, but it is presumed that growth is almost as slow as of cockroaches, which require a full year to become mature. Silverfish are primarily nocturnal, inhabiting storerooms and filing cabinets, bookcases and garages, feeding upon the paste, glue, sizing and glazing of paper and paper products. The aluminum sulfate used in glazing heavily coated paper, which to a certain extent is repellent to dry-wood termites, seems to be especially attractive to silverfish, as is also the adhesive used in the manufacture of corrugated paper or fiber boxes. Practically all methods of control generally recommended are as messy as the insects themselves: sprinkling powdered pyrethrum, borax or sodium fluoride, or a poison bait consisting of flour and white arsenic (one pint flour, to one-half ounce arsenic) making a thin paste with water and painted on cards to be distributed where the silverfish abound. The superior attractiveness of corrugated cardboard is so marked that by folding up a square of it in a drawer or letter-file, and daily killing the one or more silverfish to be found ensconced in its folds, one will soon reduce the local silverfish population to the vanishing point.

Before men had letter-files and bookcases in Puerto Rico, before the present flood of corrugated paper boxes began to arrive on the Island, silverfish lived outdoors in such dry and dark places as in dead cacti, under bark of trees and under dry leaves on the soil. Some wild silverfish, preferring a more moist environment, never entered the buildings of man, and are now found living in soil and feeding on the roots of sugar-cane, caña brava, bamboo and other plants. Dr. Folsom identified two species which had been collected in such environments by Mr. Francisco Seín as **Lepisma** sp.

and **Nicoletia** sp., presumably new and endemic. They cause considerable injury to sugar-cane, injury which becomes noticeable under unfavorable conditions such as during periods of extended drought. No method of control can be suggested, indeed there is little the cane grower can do except by general improvement of the conditions of soil and environment under which the cane is being grown.

COLLEMBOLA: Springtails

Springtails (Collembola) are minute to microscopic in size, and owe their name to the relatively enormous spring attached to the underside of next to the last abdominal segment, which they use as grasshoppers do their hind legs, for jumping. Altho presumed to be present, so little was known specifically of any springtail in Puerto Rico that at the time of the rapid spread of mosaic disease of sugar-cane, Mr. F. S. Earle wrote of the undescribed species which he thought might possibly be implicated in the transmission of mosaic disease, as follows. "This minute insect is present,



The Sugar-Cane Springtail, *Salina wolcotti* Folsom. About fifty times natural size. (After Folsom.)

literally by the million, in every cane field in Porto Rico, living, all stages together, on the lower side of the older leaves, or in very dry weather retreating into the enrolled bud spindle. Its minute scarifications are the immediate cause of most of the "ringspot" which is so common there on the older leaves." Eventually it was described by Dr. J. W. Folsom as **Salina wolcotti** ("Insects of the Sub-Class Apterygota from Central America and the West Indies" Proc. U. S. Nat. Museum, **72** (2702): Art. 6, 1–16, pl. 8, ref. 12. Washington, D. C., 1927). It is very abundant, especially during dry weather, and not only on sugar-cane and corn, but on such unlikely hosts as yautía, canna, water hyacinth and presumably many other plants. The adults are large for springtails, and readily visible without the aid of a hand-lens. They are light yellowish-green in color, with the segments of the antennae marked with brown at the joints, especially the first one. Altho occurring in such large numbers, individually they are so small that the actual damage they do to the host is negligible, and up to now they have not been implicated in the transmission of any disease.

The yellow-green *Salina* is not the only springtail to be associated with sugar-cane: under older leaf-sheaths one often finds another purplish-pink one, **Lepidocyrtus nigrosetosus** Folsom, which stands out in sharply contrasting colors against its background. It also occurs during damp weather in the cane trash on the ground, and under wet leaves of trees on the ground. This, or another species of the same genus, occurs under stones on Mona Island, as reported by Prof. J. A. Ramos in "The Insects of Mona Island." The cosmopolitan **Xenylla welchi** Folsom, as determined by Dr. Folsom, a blue-green springtail found also in Costa Rica, has been noted once in enormous numbers crowded close together on the moist earth of a ditch at Río Piedras. **Entomobrya cubensis** Folsom has been collected on decaying fruit of papaya, on cucumbers and on bamboo twigs. **Cyphodeirus inaequalis** Folsom, originally described from bat dung in limestone caves in the Canal Zone, has been collected in Puerto Rico in moss around the roots of orchids. These and the only other records of springtails: **Achorutes** sp. and **Campylothorax** sp., indicate how little this order of insects has been studied in Puerto Rico, for many other species are presumably present in favored environments such as on fungi, and in the forest mould of coffee groves and tropical rain forests.

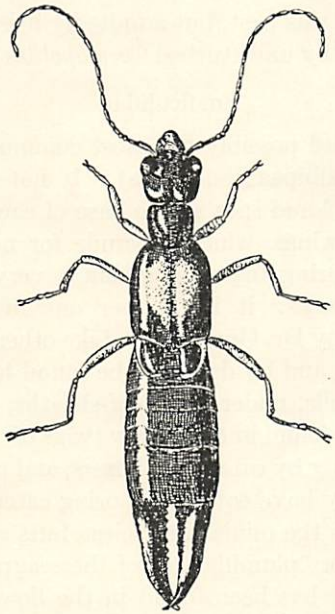
DERMAPTERA: EARWIGS

Labiduridae

The forceps at the hind end of the body of the earwig, or "pica y huye, o piquijuye" as this insect is called locally, distinguishes it from all other Puerto Rican insects, and also from the dark brown or blackish Staphylinid beetles which seem so similar to earwigs because of their short forewings, the elongate shape of the body and the type of environment where both are most often found. In the open, earwigs often run about with the hind end of their body curved back and up, displaying their forceps to the greatest advantage, if it is for warning or protection. Originally, the earwigs were considered as being only a family, Forficulidae, of the Orthoptera, but are now placed in a separate and distinct order, the Dermaptera.

The late Mr. A. N. Caudell, of the U. S. National Museum, specialist in the Orthoptera and allied orders, described from Puerto Rico as *Borellia minuta* (Jour. N. Y. Ent. Soc., **15** (3): 168. New York, 1907) what is now considered a synonym of **Euborellia stali** (Dohrn). In listing the "Dermaptera (Earwigs) of the U. S. National Museum ("Proc. U. S. Nat. Museum, **38** (1760): 443–467. Washington, D. C., August 20, 1910). Dr. Malcom Burr records from Puerto Rico *Anisolabis maritima* (Géné), *Euborellia annulipes* (Lucas) as an *Anisolabis*, and, as *Borellia janierensis* Dohrn, *Anisolabis ambigua* Borelli, and under all of these names, specimens from Puerto Rico have since been identified. Mr. Morgan Hebard (Trans. Amer. Ent. Soc., **47** (4): 322. Philadelphia, 1922) considers that all of

these records refer to but a single species, his **Euborellia caraibea.** This is a large, unmarked, shining, brown earwig with a somewhat plump abdomen, which has repeatedly been collected in the ground associated with decaying cane seed, under dead leaves, in rotten pods of *Inga laurina* and with rotten or decaying vegetables. Despite its retiring habits, it has been found in the stomachs of the crested lizards, *Anolis cristatellus* and *Anolis krugii*, and is reasonably common in all parts of the Island, from Guánica to Mayaguez, Manatí, Río Piedras and Fajardo.



Adult of *Carcinophora americana* (Palisot de Beauvois), twice natural size. (Drawn by Fritz Maximilien).

Another large earwig with light-colored head, but black eyes, which has two teeth on each jaw or tine of its forceps, is **Labidura riparia** (Pallas). Dr. Gundlach notes of this species "se encuentra debajo de las cortezas sueltas de los árboles muertos", where also he found *L. dufouri* Desm., and *L. pallipes* Duf. both now considered synonymous. As *L. bidens* Olivier it was subsequently identified, carrying a honey-bee on the plaza at Mayagüez. Dr. Luis F. Martorell found these earwigs, as identified by Dr. A. B. Gurney, abundant on Mona Island at the lighthouse at night, where they were running about collecting dead or injured insects that had been attracted to the light.

Another large earwig, **Carcinophora americana** (Palisot de Beauvois), of which Herr G. Burmeister (Handbuch der Entomologie, **2**: 753. Berlin,

1838) described the local variety in Puerto Rico as **gagathina,** has dark-colored rearwings, but the tegmina are lighter-colored along the median suture. Listed by Dr. Gundlach, and by Malcolm Burr as a *Psalis*, this was number two in Van Zwaluwenburg's list. It lives under the bark of dead trees in the mountains, having been collected at Jájome Alto (Cayey), Maricao, Naguabo and on El Duque in the Luquillo Mts. It has repeatedly been found in the trash around banana plants, and in the tunnels of the corm borer, *Cosmopolites sordidus* Germar. In the laboratory, it has been fed upon the larvae of the corm borer, and it may be a considerable factor in the control of this pest, but admitedly it is very difficult to prove that it will attack healthy undisturbed *Cosmopolites* larvae in the field.

Forficulidae

One of the largest and possibly the most common earwig at present in Pureto Rico is **Doru albipes** (Fabricius). It not only has light-colored legs, but also a light-colored spot at the base of each tegmen (or elytron), and light-colored hindwings, which protrude for nearly half their length from beneath the covering tegmina, giving a very distinctive 4-spotted appearance. As a *Phaulex* it is number one in Van Zwaluwenburg's list, but was not noted by Dr. Gundlach. Like other earwigs, it is normally nocturnal in its habits, and by day is to be found hiding under the bracts of cotton squares or bolls, under cane leaf-sheaths, or under bark of dead trees. It is often to be found in the hollow twigs of "bucare" and "jagüey" that have been left empty by caterpillar borers, and possibly from which the earwigs themselves may have eaten the boring caterpillar which made the tunnel. It also lives in the miniature Neisen huts which were the cocoons of the local pussmoth or "plumilla", or of the seagrape sawfly.

Doru lineare (Esch.) has been found in the flowers of *Inga laurina* in coffee groves in the mountains and is also reported as injuring the tips of vanilla leaves.

Labiidae

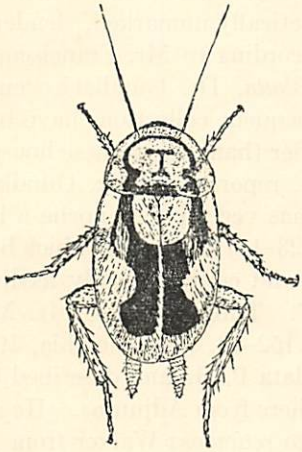
Labia curvicauda Motschulsky has been collected under the leaf-sheaths of sugar-cane, and under the base of coconut palm fronds still attached to the trees.

Labia dorsalis Burmeister was found in abundance under the bark of dead bucare trees, *Erythrina glauca*, at Cayey, where also Dr. Richard T. Cotton found in almost equal abundance the brachypterous form of **Prolabia unidentata** Palisot de Beauvois, which has only a single tooth on each jaw or tine of its forceps. A single specimen of **Prolabia arachnidis** Yersin, as determined by A. N. Caudell, has been collected on yautía.

ORTHOPTERA

Blattidae: Cockroaches

Cockroaches are certainly the largest and the most noticeable of the insects normally living as co-mensals in the houses with man in the tropics. But quite aside from these semi-domesticated, cosmopolitan species with which everyone must become altogether too familiar anywhere in the tropics, Puerto Rico is inhabited by many more wild endemic species. Most of these are wild to the extent that they normally live out of doors, but some of them seem to need a house of some kind to live in. Lacking a welcome in those of man, the little bright yellow **Aglaopteryx devia** Rehn



Adult of *Aglaopteryx devia* Rehn, three times natural size. (Drawn by F. Seín.)

is often to be found in the "nidos de mariposas", or butterfly-nests, which are formed in the leaves of the coffee shade tree, *Inga vera*, webbed together by the caterpillars of *Tetralopha scabridella* Ragonot. Where there are no butterfly-nests, it lives in abandoned spider-nests on the leaves of other forest trees. It is only in the dry climate of Mona Island where it was collected in 1913 by Mr. E. G. Smyth, that it can live comfortably under the bark of trees. Dr. Stuart T. Danforth (1926–97) found it in large numbers in the nests of the grey kingbird, in the region of the Cartagena Lagoon, "living among the twigs". Reported under the name *Ceratinoptera diaphana* F. by Mr. James A. G. Rehn (1910–73) from Culebra Island, it was subsequently described by him ("New or little known Neotropical Blattidae (Orthoptera)", Trans. Amer. Ent. Soc., **58** (2): 103–137, pl. 3, Philadelphia, April 28, 1932), the type from Aguadilla, Puerto Rico.

The type of **Aglaopteryx absimilis,** described by Dr. A. B. Gurney ("Studies in certain Genera of American Blattidae (Orthoptera)", Proc. Ent. Soc. Washington, **39** (5) : 101–112, pl. 1. Washington, D. C., May 27, 1937) was a single male collected by Dr. Richard T. Cotton, living in the abandoned cocoon of the "plumilla", *Megalopyge krugii* Dewitz, on bucare trees at Cayey. On its prothorax are markings in black suggestive of the top part of a skull, and an even more complicated pattern in black is continued on its elytra, or on the body of the wingless nymph. It has since been found in a rotten wooden fence at Pt. Salinas, Palo Seco, and on the south side of the mountains between Cayey and Salinas living between leaves of *Samanea saman.*

Puerto Rican specimens of the brown-banded roach, **Supella supellectilium** (Serville), are practically unmarked, slender and graceful. In life, it is often associated, according to Mr. Francisco Seín (1923–8) with the German roach. As a *Blatta,* Dr. Gundlach "encontrado en las casas; Mayagüez", and all subsequent collections have been in hotels or houses.

Smaller and more slender than any of these house-inhabiting roaches are five species of *Cariblatta,* reported by Dr. Gundlach as *Blatta delicatula* Guerin that "viene muchas veces por la noche a las casas, atraída por la luz" and by Mr. Seín (1923–11) as *Blatella,* which he found living "between the leaves of sugar-cane and corn, probably feeding on the excrement of caterpillars and beetles". Three of these Mr. Morgan Hebard (Trans. Amer. Ent. Soc. **42** (2): 152–63. Philadelphia, 1916) included under the name **Cariblatta punctualata** P. B., and described **Cariblatta craticula,** the type from Mayagüez, others from Adjuntas. He also listed the collection of the Jamaican *Cariblatta reticulosa* Walker from Aibonito, but Mr. J. A. G. Rehn (Notulae Naturae, No. 149, pp. 1–15, Philadelphia, March 14, 1945) corrects the Hebard record of *reticulosa* from Puerto Rico by describing **Cariblatta hebardi;** thus removing *reticulosa* from the Puerto Rican list. In their ambitious and definitive publication entitled "The Orthoptera of the West Indies. Number 1. Blattidae" (Bull. Amer. Mus. Nat. History, **54** (1): 1–320, pl. 25. New York, September 9, 1927), Messrs James A. G. Rehn and Morgan Hebard describe **Cariblatta picturata,** the type from Adjuntas, others from Coamo; **Cariblatta plagia,** the type from Arecibo, others from Río Piedras and Manatí, and **Cariblatta stenophrys,** the type from Mayagüez, others from Adjuntas

The type of **Cariblattoides suave** Rehn & Hebard (1927–49 to 52) is from Aibonito, others from Arecibo and Río Piedras.

The type of **Neoblattella borinquenensis** Rehn & Hebard (1927–80 to 83) is from El Yunque, but others are from San Juan, Caguas, Manatí and Utuado, and that of **Neoblattella vomer** Rehn & Hebard (1927–83 to 85)

is Mayagüez, others from Adjuntas and San Juan. As an *Ischnoptera* Mr. A. N. Caudell described (Canadian Entomologist, **37** (7): 237. London, Ontario, 1905) **Neoblattella adusta** from Arroyo, this, or one of the others in this genus, possibly being what Dr. Gundlach listed as *Blatta vitrea* Brunner, or *Blatta caraïbea* Saussure MS.

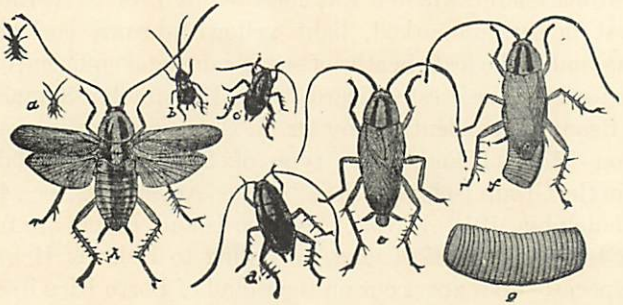
Symploce bilabiata Rehn & Hebard (1927–132 to 136), the type from Culebra Island, others from Aguas Claras, San Juan and Dorado, also occurs on Mona Island, where it was collected by Prof. J. A. Ramos. It is a somewhat larger, unmarked, light yellowish-brown cockroach, often found living under the leaf-sheaths of sugar-cane, and sufficiently abundant to serve as food for the crested lizard. The Hispaniolan **Symploce bicolor** Palisot de Beauvois, as identified by Dr. A. B. Gurney, has repeatedly been collected on Mona Island. The type of **Symploce flagellata** Hebard ("Studies in the Group Ischnopterites," Trans. Amer. Ent. Soc., **42** (4): 367, pl. 23, Philadelphia, 1916) is from Desecheo Island, others are from Mona, and Saona Island, Hispaniola, and, according to Rehn & Hebard (1927–136), this species "does not occur on the island of Porto Rico itself".

Considerably larger and darker than all the little wild yellow roaches previously mentioned is **Ischnoptera rufa rufa** (DeGeer), a continental cockroach originally described from Surinam, first reported from Puerto Rico by Carl Brunner von Wattenwyl ("Nouveau Systeme de Blattaires," p. 131. Paris, 1865), and as *I. rufescens* Beauvois by Mr. Rehn (1910–73) from Culebra Island. Rehn & Hebard (1927–112) note occurrence at Arecibo and Ensenada, but state that "none of the material was taken in forest conditions." Altho present at Río Piedras, and collected in fruit fly trap at Bayamón, this large cockroach is much more common in the mountains, being brought into houses on bunches of bananas, as at Lares, or flying into houses at night from the surrounding forest, as at El Verde in the Luquillo Mountains. One found dead, stuck to a leaf and covered with a green fungus, *Spicaria prasina* (Maubl.) Saw., as determined by Miss Vera K. Charles, was found at El Verde.

The type of the much broader, reddish-brown **Pelmatosilpha coriacea** Rehn was from El Yunque (James A. G. Rehn, "Studies in American Blattidae", Trans. Amer. Ent. Soc., **29** (3): 273. Philadelphia, September 1903), but has since been found quite common not only in the mountains but along the coast, and even on Mona Island. Under the loose bark of tortugo amarillo (*Sideroxylon foetidissimum*), it is very much at home.

The German cockroach, the light, yellow-brown, slender **Blattella germanica** (L.), may be distinguished by the dark-colored inverted "U" on its prothorax. Despite its small size and slender build, it appears to have conquered all of the tropical world, including even Mona Island. This is

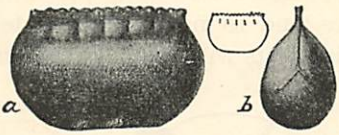
in part due to the habit of the female of always carrying her egg-cluster or oötheca with her until the eggs hatch, and also to the rapidity of growth of the nymphs, as was indicated by the investigations of Mr. Francisco Seín Jr. ("Cucarachas", Circ. No. 64, Estación Experimental Insular, pp. 3–12, fig. 9. Río Piedras, January 1928). Indeed, the nymphs develop so rapidly as to moult to adult within two months after hatching, and females appear with oötheca ten days later.



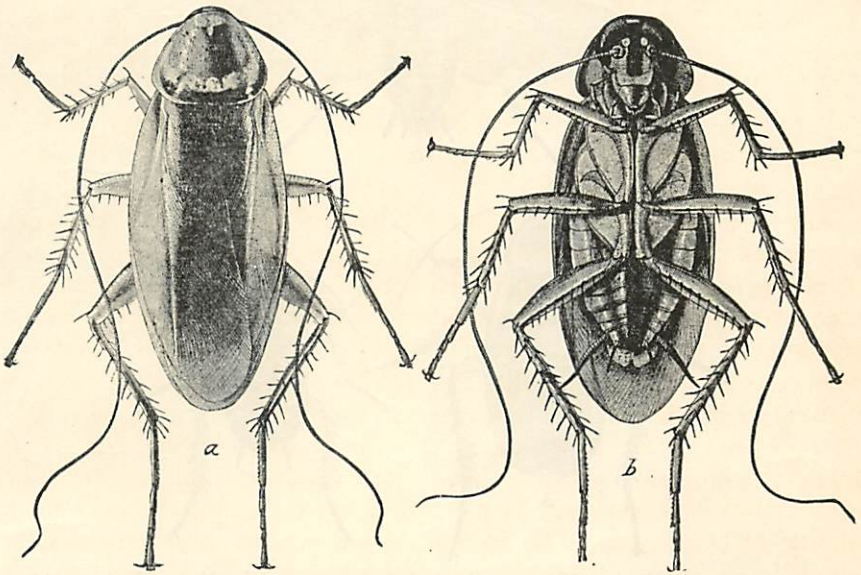
Blattella germanica (L.). All stages: egg to adult. Natural size. (After Riley.)

The much larger and more powerful domestic cockroaches, **Periplaneta americana** (L.), **P. australasiae** (F.) and **P. brunnea** Burmeister, have very definitely fallen behind in Puerto Rico in competition with the little German roach, especially since automatic kerosene, gas-powered and electric refrigerators have come into general use. The old-fashioned "real ice" refrigerators, of necessity had a drain for the escape of the water from the melting ice inside, and thru this, access to the interior was always available to the roaches. The new refrigerators have no such opening, and are absolutely tight, once the door is closed. Even if a cockroach, or ant, or any other insect, is accidentally introduced with food, it quickly finds an environment much too cold for comfort, rather than one gradually warming up as the ice melts. What this means in keeping food free from insects in the tropics can only be realized by one who has used both kinds of refrigerators: certainly one advance due to modern technology which nobody can criticise. But this seems to make little difference to the German roach, which disappears or appears in swarms as unaccountably and mysteriously in even the most scrupulously clean household, where the larger cockroaches never have a chance. Indeed, these larger roaches seem beset with enemies, for the females glue their oötheca to cracks in the wall, or in some other convenient crevice, and it is over a month before the nymphs hatch. During all of this time the egg-cluster is exposed to possible destruction by the careful housewife. Even in the most carelessly kept houses, or in garages or warehouses it is subject to attack by two parasitic wasps. The

shining black, nervous *Evania appendigaster* L., with a most surprising, short, triangular, stalked abdomen, is often seen in likely places looking for cockroach egg-clusters, of which an entire oötheca serves as nourishment for the development of but a single wasp. The much less obvious and much smaller *Tetrastichus hagenowi* Ratzeburg, another parasite of the



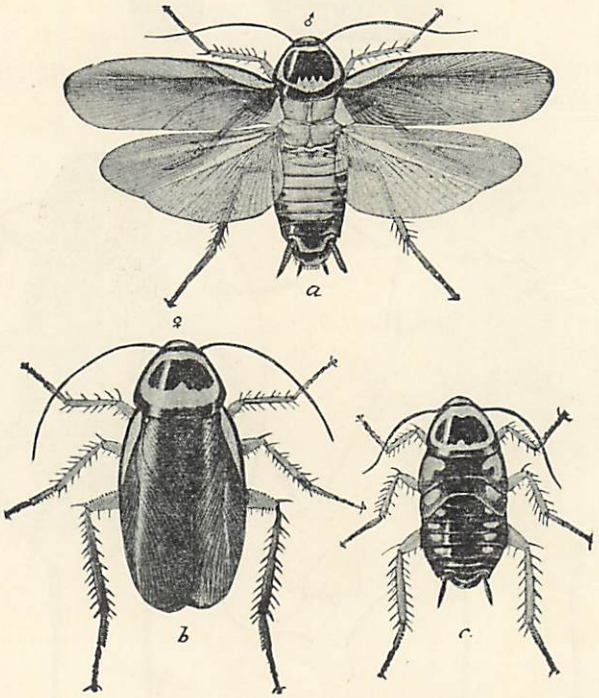
Oötheca of the American Cockroach, *Periplaneta americana* (L.), from the side and end, four times natural size. (After Marlatt.)



Periplaneta americana (L.), *a.* from above, *b.* from beneath. One and one-third times natural size. (After Marlatt.)

egg-clusters of *Periplaneta americana*, is often even more abundant. Many wasp larvae find nourishment for development in a single large cockroach oötheca. And if the nymphs of these large cockroaches succeed in hatching, despite the hazards to which they are exposed while in the unprotected egg-stage, they develop to adult with the most tiresome slowness even in the tropics. Mr. Seín found that the American roach required almost a year before finally moulting to adult, and the others at least five months. One more factor tending towards elimination is that the manufacturers of

the phosphorus paste, which, lightly spread on crackers, is so effective in attracting and killing cockroaches, now market their product in a collapsible tube, which greatly simplifies application to the crackers without getting the stinking poison on one's fingers. The general use of DDT sprays has also done much to rid houses of cockroaches, for altho they are not at once killed by anything weaker than a 10% application, the weaker applications against mosquitoes tend to make their haunts much less attractive. Mr. H. K. Plank, making tests with mamey-seed dust (Mayagüez Station

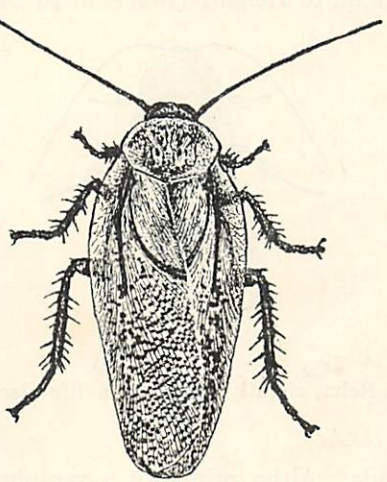


Periplaneta australasiae (F.), *a*. male, *b*. female, *c*. nymph. Natural size. (After Marlatt.)

Report for 1946, p. 12) found that adults of these larger roaches die in less than 20 hours when dusted with "a half-and-half mixture of technical sodium fluoride and wheat flour".

Of these three common, large reddish-brown domestic species, *Periplaneta australasiae* (F.) has a well-marked pattern in bright yellow on its prothorax, surrounding coalescing rounded areas; *Periplaneta americana* (L.) is more elongate, with the pattern on the prothorax much less sharp and with less contrasting coloration; while *Periplaneta brunnea* Burmeister has least pattern on its prothorax, is darkest in general coloration and is intermediate in size.

The very largest and darkest reddish-brown cockroach in Puerto Rico, **Nyctibora lutzi** Rehn & Hebard, described from Guánica (1927–193 to 194), with others from Utuado, is possibly to be found most often in the highest mountains, in rotten tree trunks. Some found at San Sebastián were in a large rotten stump which they shared with "comején" termites, yellow wood-ants and rhinoceros beetle grubs. Its distinctively large oötheca is elongated wedge-shaped, the little nymphs escaping by a hole eaten at the sharp edge of the wedge. As in the case of the large domestic cockroaches, growth of these nymphs is slow, over six months elapsing before they become adult. The nymphs may be distinguished by a covering of a milky mucilaginous substance covering the last two abdominal segments dorsally and the anal plates.



"La Cucaracha fatula," *Leucophaea maderae* (F.), natural size. (Drawn by F. Seín.)

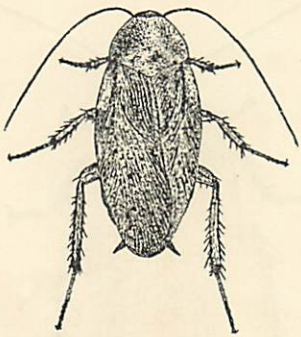
An almost equally large, speckled, yellow-brown species, "la cucaracha fatula", **Leucophaea maderae** (F.), is semi-domesticated, and is to be found most often in fruit stores or markets, sometimes in enormous abundance. From one little fruit store, the owner claimed to have cleaned out over a bushel of these cockroaches. They are not only gregarious, but the mother broods over her young, and together they sally forth at night in search for food, until they are of such a size as to mingle with their elders. When small, the nymphs are so transparent that the food eaten can be seen within their bodies, and growth is so slow that Mr. Seín found that it is often a year before they become adult.

Leurolestes pallidus (Brunner) was collected at Utuado by Dr. Wm. M. Wheeler, and has not since been noted.

The species of **Epilampra** collected at Utuado by Dr. Wheeler, and named for him by Rehn (1910–73), is a large yellowish-brown species with speckled

wings, and with difficulty distinguished from the more common low-land species, **Epilampra abdomen-nigrum** (DeGeer), which is abundant in wet malojillo meadows. Mr. Seín found it viviparous, the female giving birth to 35 to 50 nymphs at a time. The nymphs swim with ease and often remain beneath the water surface for long periods, as do also the adults. The type of **Epilampra mona** Rehn & Hebard (1927–216 to 218) was from Mona Island.

Pycnoscelus surinamensis (L.) is a broad, brown, medium-sized cockroach, so slippery that it does not so much run away as slip between debris, and easily eludes efforts at its capture. As *Panchlora*, Dr. Gundlach records that it "vive debajo de las piedras, tablas, etc.; también en las casas, en tierra". As a *Leucophaea*, Dr. Wetmore notes it having been eaten by the woodpecker. Rehn & Hebard (1927–243 to 245) found it on Mona



Epilampra wheeleri Rehn, slightly larger than life size. (Drawn by Francisco Seín.)

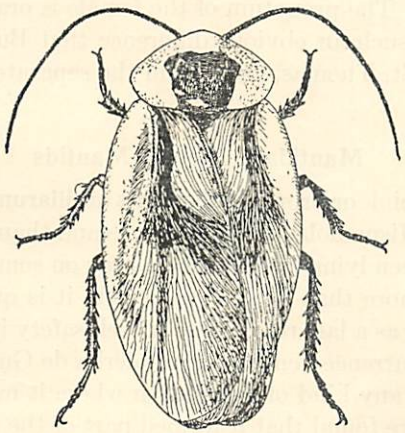
and Desecheo Islands. Altho primarily a xerophytic species: collected among dry stones on Mona Island, under dry cow dung at Boquerón, and under boxes at Guánica, it is reasonably common in the more humid parts of Puerto Rico, having been found by Mr. Seín under flower-pots in the garden at Lares. He reared the nymphs at Río Piedras in earth, feeding them on corn: the first, born on September 10th, 1922 becoming adult by the third of April in the following year, and the one slowest to develop becoming adult in June.

The beautiful light green cockroaches, of which, under the names *Panchlora viridis* F. and *Panchlora nivea* L., Dr. Gundlach notes the habits, "vive debajo de las cortezas sueltas de los árboles muertos, o debajo de las piedras, tablas, etc." They have since been identified as **Panchlora cubensis** Saussure. Rehn & Hebard (1927–251 to 254) described another as **Panchlora sagax,** the type from Dominica, others from Río Piedras, San Juan, Loíza, Adjuntas, Aibonito and Culebra Island. Sometimes individ-

ual adults are attracted to lights, but most have been collected from the very rotten interior of coconut palms. Mr. Seín, rearing the brown nymphs from two females, one from bananas, the other from rotten palm at Loíza Aldea, found that they became of full size in 100 days, and moulted to green adults despite having fed on the rotten brown fiber of the palm during all of their nymphal existence.

Aspiduchus deplanatus Saussure, noted by H. E. Crampton in limestone cavern at Corozal, "by thousands in grass and on walls", according to Rehn & Hebard (1927–279), had previously been recorded from Puerto Rico by Dr. Gundlach, "debajo de las piedras y de hojarasca".

Hemiblabera brunneri (Saussure) has short wings, covering but half the abdomen, dark reddish in color. The only recent collection is of a female found under the bark of a fence-post at Boquerón, who laid one cluster of eggs before her death in captivity. Under the name *Hemiblabera manca*, Saussure (Soc. Entom., VIII, p. 68. 1893) had described a male collected in Puerto Rico, and Mr. Aug. Busck had found a female on Culebra Island in 1899.



Blaberus discoidalis Serville. Natural size. (Drawn by F. Maximilien.)

Blaberus discoidalis Serville is a very large yellowish-brown cockroach with a broad black triangle on its exceptionally large and broad prothorax. It has been found mingled with *Leucophaea maderae* in fruit debris, but is by no means so abundant.

In contrast to these giants are the quite minute **Plectoptera dorsalis** (Burmeister) and **P. rhabdota** and **infulata** both described by Rehn & Hebard (1927–305 to 307 and 314 to 316) from Puerto Rico. All are light greenish-yellow when alive, living in trees between leaves, or in "butterfly-nests" of *Tetralopha scabiridella* in leaves of *Inga vera*, or of *Pilocrocis secer-*

nalis in the leaves of "capá blanco" (*Petitia domingensis*) in the mountains. Along the coast, they have been found under the bracts of cotton squares or bolls, and under the leaf-sheaths of sugar-cane, in curled-up leaves of grapefruit, or in the dry flower clusters of "espino rubial" (*Zanthoxylum caribaeum*). Those which he found living on leaves of "jobo" (*Spondias mombin*), Mr. E. G. Smyth thought must feed on "cast skins of Aleyrodids, thrips, Jassids, etc.". Under the name of *Plectoptera poeyi*, Dr. Wetmore records finding one of these little cockroaches eaten by the tody, and Mr. Rehn (1903–131) lists occurrence on Vieques Island. As *Plectoptera porcellana* Saussure, Dr. Gundlach notes that they "vive debajo de las cortezas sueltas de árboles muertos y vuela de noche a las casas atraída por la luz", and lists others under the name *P. unicolor* Burmeister.

The very smallest cockroach in Puerto Rico is **Holocampsa nitidula** (F.). Noted by Dr. Gundlach under the names *H. collaris* Burm. and *H. cyanea* Burm., "en las casas debajo de las tablas y otros objetos", one rarely finds them in houses in the mountains, in coffee groves or virgin forest. They are distinctively blue-black in color, with a large rounded orange-yellow spot on the wings. The pronotum of the female is orange in color, that of the male blackish, such an obvious difference that Burmeister, describing those collected on St. Thomas, gave them the separate names used by Dr. Gundlach.

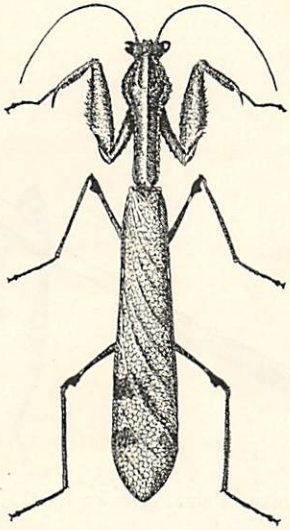
Mantidae: Preying Mantids

The little green, pink or brown **Callimantis antillarum** (Saussure) is much more abundant in Hispaniola and on Mona Island than it is in Puerto Rico, and is often to be seen lying in wait for its prey on some outstretched frond of leaves. Little more than an inch in length, it is quick and active, and when pursued, only as a last resort does it seek safety in flight. Dr. Gundlach reports its occurrence "encima de la hierba de Guinea en Mayagüez", but it may rest on any kind of vegetation where it may catch smaller insects. Dr. Wetmore found that it formed part of the food of the kingbird, the ani and the mangrove cuckoo in Puerto Rico, and Dr. Stuart T. Danforth collected a mangrove cuckoo near Lake Miragoane, Haiti, that had eaten one.

The grey, speckled **Gonatista grisea** (F.) is more than twice its size; a clumsy monster sometimes attracted to lights, as terrifying to the stoutest-hearted man (or woman) as it is dangerous to any insect of reasonable size that comes within reach of its powerful front legs. Dr. Gundlach reports finding it "sobre los arbustos en la maleza y monte" and it has since been noted in a grapefruit grove at Pueblo Viejo, in a coffee grove at Lares, and attracted to light at Guánica.

Gonatista reticulata (Thunberg) has been recorded from Puerto Rico by Mr. A. N. Caudell (Psyche, **19** (5): 160-2. Cambridge, 1912), but none has since been collected here.

It might appear that the scarcity of preying mantids, both of species and of individuals, in Puerto Rico, is due to the relatively larger area of land under intensive cultivation, and to the number of people, even tho there would seem to be no possibility of direct competition with man. This is the more obvious when considering the extensive wilderness, desert or forested areas of Hispaniola and Mona, and despite the presence there



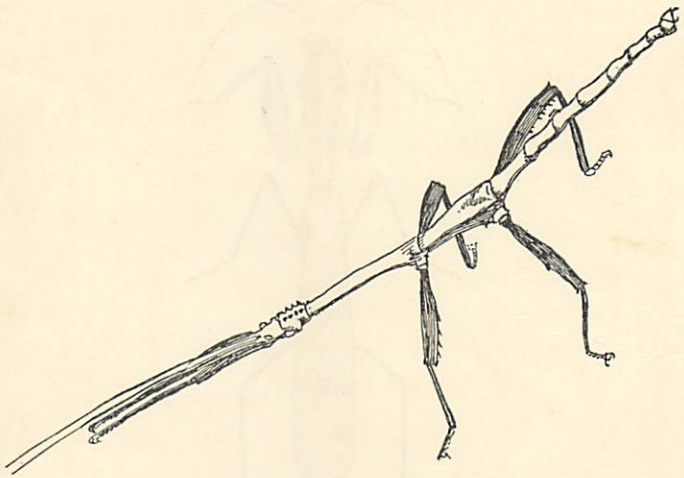
Epaphrodita musarum Palisot de Beauvois, an Hispaniolan Mantid, not reported from Puerto Rico, natural size. (Drawn by Fritz Maximilien.)

of an egg-parasite, *Podagrion texanus* Ashmead, which oviposits in the leathery egg-masses of *Gonatista*. Those of *Callimantis* in Puerto Rico are parasitized by an Eupelmid wasp: *Anastatus viridicaput* Gahan, and on Mona by a new species of *Anastatus* which has enormous clubbed antennae, even if its head is not green. Certainly nobody in Puerto Rico, except possibly the most ardent entomologists, would prefer that these fearsome creatures should be more numerous here.

Phasmidae: Walking Sticks

The walking sticks are as exclusively plant-feeding as the preying mantids are predaceous, and by their unique appearance, resembling twigs or moss-covered branches, should be even better protected against their natural

enemies. Indeed, the only reference to any Phasmid eaten by any bird in Puerto Rico given by Dr. Wetmore is of *Aplopus achalus* Rehn eaten by the mangrove cuckoo. Possibly because none of the walking sticks attacks any cultivated crop, all those which might possibly have been abundant in the level coastal areas, before they were brought under cultivation, are now scarce. The only exception appears to be that Phasmid attacking the tender leaves of the common shrub or small tree locally known as "cafeíllo cimarrón" (*Casearia sylvestris*), of which the most slender and fragile nymphs are often noted, but no adult has been collected on a plant identified



The Tupa *Lamponius*, natural size. (Drawn by G. N. Wolcott, original.)

as this host, and we can only guess that it is one of the species of *Dyme*. It may be, and probably is **Dyme haita** (Westwood), identified by Mr. A. N. Caudell, with *Bacunulus dryas* Westwood in synonymy, collected on shrubs at Bayamón and Caguas, and in a coffee grove at Lares.

This species is recorded by Messrs Harold K. Plank and H. F. Winters in their account of the "Insects and other Animal Pests of Chinchona and their Control in Puerto Rico" (Bulletin No. 46 Federal Experiment Station, Mayagüez, pp. 16, fig. 5, ref. 16. Washington, D. C., February 1949) as found "on the leaves of low bushy plants, *Pilea* sp., probably *yunquensis* (Urban) Britton & Wilson, growing nearby, and could be considered as at least a potential pest of *Chinchona*." Unidentified species of *Dyme* were found definitely feeding on the leaves of *Chinchona* in the nursery at Toro Negro, as well as a species of *Lamponius* and several species of *Antillophilus*, the only one identified to species being *Aplopus achalus*.

The types of both **Dyme krugiana,** described by Carl Brunner von Wattenwyl ("Die Ins. Fam. der Phasmiden", p. 324. Leipzig, 1907), and

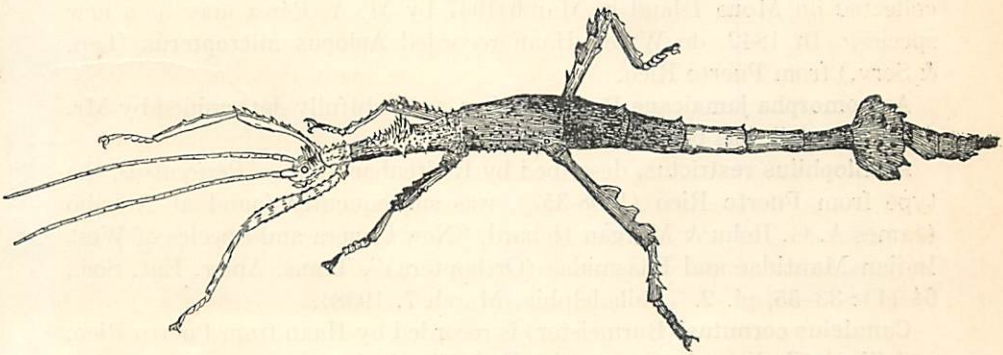
of **Dyme yersiniana,** described as a *Bacteria* by H. Saussure ("Phasmidarum novarum species non nullae", Rev. et Mag. Zool., **20** (2): 65. 1868) were from Puerto Rico, the latter having been collected by Dr. Gundlach and listed by him as found "en los montes o malezas".

As *Bacteria spinosus* Burm., de Willem Haan ("Bijdragen tot de Kennis der Orthoptera", Verhand de Natur. Gesch. der Nederl. Overzeesch, Bezitt, etc., Orthoptera, p. 102. Leiden, 1842) records the presence of **Bacteria calamus** Fabricius in Puerto Rico.

The type of **Lamponius bockii,** described by J. Redtenbacher ("Die Ins. Fam. der Phasmiden", p. 357. Leipzig, 1908) is from Mona Island. No Phasmid, except one, has subsequently been collected on Mona.

As a *Pygirhychus*, Dr. Gundlach reports "hemos cogido solamente una larva" of **Lamponius guerinii** Saussure.

Between the Mt. Britton road and the point where the Mt. Britton trail meets the jeep road to El Yunque radar station, plants of what is locally known as "tibey" (*Tupa portoricensis*) may often be noted with some leaves eaten by what Mr. James A. G. Rehn considers to be a new species of **Lamponius.** Nymphs of all sizes and adults are possibly most abundant in autumn, but once one knows what to expect, at least adults may be seen at any time of year. These insects are characterized by resting with their head down, and forelegs and antennae extended and closely appressed, *down* the stem of the plant, but with the tail end up and curved over. All the nymphs are green, but adults may be green, grey or brown. The same, or another species, occurs on "camasey" (*Miconia guianensis*).



Phibalosoma ceratocephalum Gray, natural size. (Drawn by G. N. Wolcott, original.)

"Tibey" is also host for another Phasmid with a posterior rudder, spined and so covered with moss and lichen-like markings as to resemble a dead twig. The females are larger and stouter than the males, but otherwise in coloration, spines and posterior rudder, closely resemble the slender males. This is **Phibalosoma ceratocephalum** (Gray), a Brasilian species considered

by Redtenbacher to be the same as *Acanthoderus* (*Xylodus*) *adumbratus* which H. Saussure ("Orthoptera Novae", Rev. Mag. Zool., **9** (2): 62. 1859) named and described from specimens collected by Dr. Gundlach at Mayagüez. Despite the accurately descriptive character of the specific name used by Gray, as applied to the Puerto Rican horny-headed walking stick, Dr. A. B. Gurney doubts Redtenbacher's synonymy and implies the correctness of using Saussure's *adumbratus* for our local "tibey"-eating species.

Diapherodes longiscapha Redtenbacher (1908-435), the type from Puerto Rico, has since been collected on *Inga vera* at Lares, and repeatedly on weeds along the roadside up El Yunque, all of these having been identified by Dr. A. B. Gurney. The adult is bright green in color, five inches in over-all length, with a comparatively stout and somewhat spiny body, the rudimentary forewings being much larger than the minute hindwings. **Diapherodes gigantea** (Gmelin), (=*D. gigas* Drury) also occurs here, according to Mr. Caudell. Either may be *D. krugii*, Saussure's MS name for specimens collected by Dr. Gundlach at Mayagüez. The record from the Luquillo Mountains of *Diapheromera femorata* (Say), the common walking stick of the eastern United States, seems doubtful.

Aplopus jamaicensis (Drury), collected recently on *Inga vera* at Lares, has rudimentary wings, the front ones so small they hardly reach half-way towards the base of the somewhat larger hindwings. According to Redtenbacher, the *Aplopus achalus*, described from Puerto Rico by Mr. James A. G. Rehn (Proc. Acad. Nat. Sci., Philadelphia, **56**: 68. Philadelphia, 1904) may be in synonymy. Dr. A. B. Gurney considers that the **Aplopus** collected on Mona Island in March 1937 by M. A. Pérez may be a new species. In 1842, de Willen Haan recorded **Aplopus micropterus** (Lep. & Serv.) from Puerto Rico.

Anisomorpha jamaicana Redtenbacher, as doubtfully determined by Mr. A. N. Caudell, has been collected at Ponce.

Antillophilus restrictus, described by Redtenbacher as a *Pericentrus*, the type from Puerto Rico (1908-357), was subsequently found at Arecibo (James A. G. Rehn & Morgan Hebard, "New Genera and Species of West Indian Mantidae and Phasmidae (Orthoptera)", Trans. Amer. Ent. Soc., **64** (1): 33–55, pl. 2. Philadelphia, March 7, 1938).

Canuleius cornutus (Burmeister) is recorded by Haan from Puerto Rico, and **Clonistria linearis** (Drury) by Redtenbacher.

Tetrigidae: Pigmy Locusts

The pigmy locusts, at first glance, look like grasshoppers, but differ most obviously in the size of the pronotum, which is so long as to extend beyond the tip of the abdomen, thus taking the place of the forewings or tegmina, of which these grasshoppers have only small, scale-like, lateral vestiges.

A single common species occurs in Puerto Rico: **Paratettix frey-gessneri** Bolivar, present also on Mona Island. Of its habits, under the name *Tettix caudata* Saussure (a mis-identification), Dr. Gundlach says "en parajes húmedos, v. gr. al lado de lagunas". Rarely they are attracted to lights, but normally one will find these little dark brown or blackish locusts just where Gundlach indicates, in wet "malojillo" meadows, or at the edge of lagoons.

A less common species, **Micronotus quadriundulatus** (Redtenbacher), as determined by Mr. A. N. Caudell, has been collected once at Mayagüez.

Acrididae or Locustidae: Grasshoppers

Puerto Rico is either too wet or too dry for grasshoppers, possessing little of the semi-arid, uncultivated level areas of the great plains of the western United States, northern Venezuela and north Africa where these insects thrive. The dusty, dirty brown and somewhat plump **Sphingonotus haitiensis** (Saussure) is sometimes quite common in the areas, restricted in size, but typical in character, where grasshoppers thrive: on the margins of the lagoons of Guánica, Cartagena and Tortuguero, and on the airport landing on Mona Island. (Recorded by Messrs Rehn & Hebard (Trans. Amer. Ent. Soc., **64** (3): 212. Philadelphia, 1938) as Ensenada and Manatí, their new record being Coamo Springs.)

The more slender, green **Orphulella punctata** (DeGeer) has been collected in the garden at Guánica, and rarely at Mayagüez.

The larger **Rhammatocerus gregarius** (Saussure), brown with a sharply-defined yellowish-green stripe down the center of its back, has a much wider distribution in Puerto Rico, and is found in cane fields and pastures generally around the coast. As a *Stenobothrus* it was listed by Dr. Gundlach; as a *Plectrotettix* it is recorded by Dr. Wetmore as having been eaten by the green heron, the ani and the mocking bird, and by the writer (1924–11) eaten by the iguana, *Ameiva exsul:* and as a *Scyllina* has been noted as a minor pest of a sugar-cane and beans. In 1913 it was collected on Mona Island by Mr. E. G. Smyth, and has repeatedly been found there since. The nymphs have been noted feeding exclusively on the leaves of *Solanum persicifolium* on the cliffs between Isabela and the ocean, and not on other Solanaceous plants near-by, but it is doubtful if they are often this restricted in their choice of food. Adults have been collected on eggplant and tomato, which may be more attractive as food plants than grass and sugar-cane.

Schistocerca americana (Drury) is the largest grasshopper occurring in Puerto Rico and on Mona Island, many adults being two and three-quarters inches long, not including the antennae; **Schistocerca colombina** (Thunberg) may have some smaller individuals, but most are equally large, as is

also **S. pallens** (Thunberg). The observable differences between the species are slight. Dr. Gundlach lists them as *Schistocerca cancellatum* Serv., *S. obscurum* F., and *S. peregrinum* Olivier, and Dr. Stahl all in the genus *Acridium*. Mr. James A. G. Rehn (1910 76) uses the name *Schistocerca aegypta* Thunberg for his records of collection in Puerto Rico and on Culebra and Vieques Islands. The adults probably, and the nymphs unquestionably do feed on the leaves of sugar-cane, but the actual damage caused is negligible because of the normal scarcity of the insects. However, during dry winters, one may see the nymphs, entirely green in color, with a delicate bloom, gradually increase in size in fields of young cane from November to February, until the first yellow-brown adults appear in March. When adults are noticeable in December, one may expect a real outbreak by spring, as occurred at Yabucoa in 1943. Sugar-cane is not the only host, and pokeweed (*Phytolacca decandra*) is preferred, when available. These big grasshoppers look like real food to the larger birds, and Dr. Wetmore found their remains in the stomaches of the ani, the petchary and the kingbird. They are also eaten by the common ground lizard or iguana, *Ameiva exsul*.

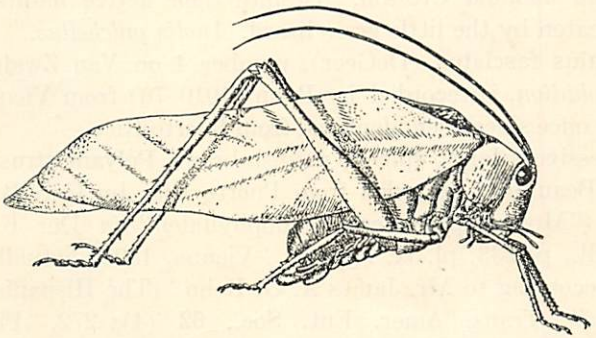
Tettigoniidae: Katydids

Microcentrum triangulatum Brunner is the common large, green, broad-winged katydid of Puerto Rico, found in all parts of the Island, as well as on Mona. The grey, leathery oval eggs are laid in a single row along the edge or midrib of almost any kind of leaf, and the nymphs hatching are varigated and bright-colored. In later instars they become mostly green except at the end of the longest segments of their legs, and at the angles of the wings, which are brown. In the last instar they are entirely green, like most adults. Some adults, however, are not green, and those feeding on bright-leaved Crotons are light yellow, stained a deep pink along the wing veins and where the chitinization is thickest. Both nymphs and adults feed on the leaves of many trees and plants besides those of Croton: rose bushes and flowers, cotton leaves and bracts, the leaves of grapefruit, moca, capá blanco, lignum-vitae and guaraguao having been definitely noted. Dr. Wetmore records only the mangrove cuckoo as feeding on this specific katydid, but notes that the sparrow hawk had eaten "a good many katydids". The writer has seen a hawk in Santo Domingo so repeatedly return to its perch with these katydids, from which it pulled off wings and legs, that dozens of these unwanted and inedible parts accumulated on the ground underneath.

The much less common, smaller, green **Turpilia rugulosa** Brunner is found around the coast, but we know little of its habits.

Anaulacomera laticauda Brunner is a more slender green katydid with narrow wings, found in coffee groves and forests of the mountains.

The largest of the narrow-winged katydids, or cone-headed grasshoppers, belong to the genus **Neoconocephalus,** of which **N. guttatus** (Serville) and **N. maxillosus** (F.) inhabit the high mountains. **Neoconocephalus obscurellus** (Redtenbacher), as a *Conocephalus*, was number 5 on Van Zwaluwenburg's list, presumably from Mayagüez or the Mayagüez region. The common low-land species is **Neoconocephalus triops** (L.), of which the green individuals are called var. **macropterus** Redtenbacher, and the brown ones var. **fuscostriatus** Redtenbacher. As *Conocephalus nieti* Saussure, Dr. Gundlach lists this species from Mayagüez. The ovipositor of the female is almost as long as all the rest of her body, and with it



The Hispaniolan Katydid, *Phoebolampta excellans* (Walker), natural size. (Drawn by Fritz Maximilien.)

she inserts her eggs far down in the central spindle of leaves of high sugar-cane. One egg-cluster, observed on Vieques Island, consisted of nine eggs, about half an inch long, light green in color and considerably flattened by the pressure between the leaf-sheaths. Adults often hide far down in the leaf-spindle of sugar-cane, but not necessarily anywhere near where they have been feeding, so that actual injury by either nymphs or adults can not be assessed with certainty. They are really very minor pests of cane, despite the large size of the individual. They are eaten by most of the larger birds; Dr. Wetmore reporting the green heron, the ani, the mozambique, mangrove cuckoo and flycatcher, and Dr. Danforth the grackle, the thrush and the sparrow hawk. The stomach contents of the judío and the clérigo (birds shot by Martorell) examined by the writer, in part consisted of their ungainly legs and wings. Mrs. Dexter found their remains in the stomachs of the imported toad, *Bufo marinus*. Adults often come to lights, usually singly, but sometimes in clouds, as in November 1944, not

only annoying but frightening movie patrons, as they fluttered about the brilliantly illuminated marqués in Santurce. On the roughened walls of the University buildings they found firm footing: hundreds of green and dozens of brown katydids coming to rest in the light, undisturbed by the passing of students.

The much smaller **Conocephalus cinereus** Thunberg, green with a broad brown dorsal stripe, is also found in sugar-cane, especially young cane, and in rice or similar coarse grasses, on Guinea grass on Mona (Ramos), and in "malojillo" meadows. When abundant, they may even attack tobacco seedlings, as at San Lorenzo in 1944, eating out rounded holes near the midrib. Their immobilized body often serves as food for the larvae of the Sphecid wasps, such as *Tachytes insularis* Cresson, *Prionoyx thomae* F., and *Ammobia dubitata* Cresson. Despite their active habits, they are caught and eaten by the little grass lizard, *Anolis pulchellus*.

Conocephalus fasciatus (DeGeer), number 4 on Van Zwaluwenburg's list as a *Xiphidion*, is recorded by Rehn (1910–76) from Vieques Island, but has only once since been identified from Puerto Rico.

The impressively large, spined, reddish-brown **Polyancistrus serrulatus** (Palisot de Beauvois), recorded from Puerto Rico by Carl Brunner von Wattenwyl ("Monographie der Pseudophylliden" *in* Der K. K. Zool. Botan. Gesell., p. 233, pl. ix, fig. 101. Vienna, 1895) actually does not occur here according to Mr. James A. G. Rehn "(The Hispaniolan Genus *Polyancistrus*", Trans. Amer. Ent. Soc., **62** (4): 272. Philadelphia, December 30, 1936), as there is no record of collection, even from Mona Island.

Of the large, reddish-brown nymphs identified by Mr. A. N. Caudell as a species of **Gryllacris**, collected from spider nest in curled-up leaves of an abandoned coffee grove at Indiera, no adult has ever been found.

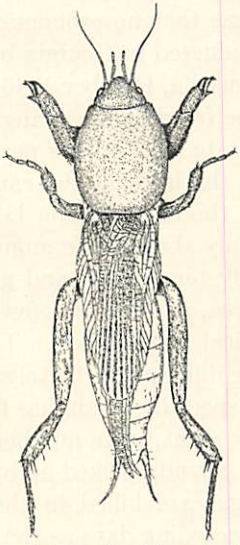
Phlugis virens (Thunberg) was re-described under the name of *Alogopteron caribbeum*, the type from Puerto Rico, by Mr. James A. G. Rehn (Entomological News, **14** (4): 141. Philadelphia, 1903), but has not since been collected here.

Gryllidae: Crickets

The "changa" or so-called Puerto Rican mole-cricket, **Scapteriscus vicinus** Scudder, is probably not endemic at all, but was accidentally introduced in commerce from South America, possibly in guano from Perú, and became a serious pest within the memory of Dr. Augustín Stahl. Under the name *Gryllotalpa hexadactyla* Perty, Dr. Gundlach wrote of it: "Esta especie abunda en Mayagüez y vuela muy frecuentemente a la luz de las casas. Vive en la tierra donde hace daño. Por la noche, principalmente después de un aguacero fuerte, deja oir un sonido muy

monótono, pero suave, producido por la fricción de sus alas; si uno se aproxima, cesa el sonido, pues el insecto percibe la pisada. Para cogerlo es menester aproximarse con sumo cuidado, averiguar donde suena y sacar con un golpe de guataca la tierra con el insecto." It occurs in abundance in all humid parts of the Island, more especially in the sandy regions, but appears even in the most xerophytic regions after heavy rains, and is present also high in the forested mountains.

The first economic account of "The Changa or Mole Cricket" is by Mr. O. W. Barrett (Bull. No. 2, P. R. Agr. Expt. Station, pp, 19, fig. 1. Mayagüez, 1902), and what was anticipated would prove the definitive



Adult Changa, *Scapteriscus vicinus* Scudder, twice natural size. (Drawn by F. Sefn.)

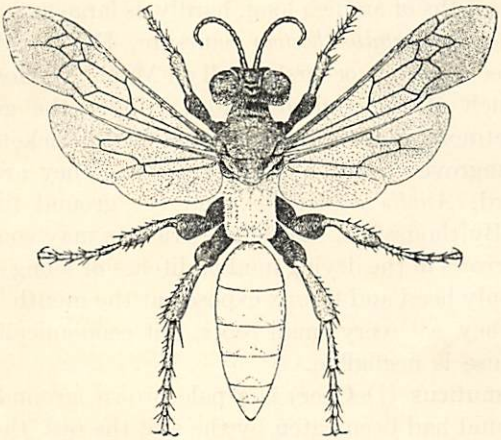
publication is by Mr. R. H. Van Zwaluwenburg: Bulletin No. 23 of the Mayagüez Station (pp. 27, pl. 3. Washington, D. C., 1918). Dr. Alexander Wetmore in his economic study of the food habits of the "Birds of Porto Rico" (Bull. No. 15, Board of Commissioners of Agr. P. R., also Bull. No. 326, (Professional Paper) U. S. Dept. Agr., pp. 1–140, pl. 10., many ref. Washington, D. C., March 24, 1916) found that the changa constituted over half the food of the Cuban green heron, and over a quarter of the food of the Puerto Rican sparrow hawk, nearly a sixth of that of the killdeer and a tenth of that of the spotted sandpiper. Studying the food habits of the "Birds of the Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 33–106, pl. 8. San Juan, January 1931), Dr. Stuart T. Danforth found that the changa is also eaten by the ani, the pied-billed grebe, and the

little blue heron. The common grass lizard, *Anolis pulchellus*, eats the small nymphs, but no lizard the adults. The Surinam toad finds the changa too nervous and rapid in its movements to be easily captured. Indeed, Mrs. Raquel R. Dexter's studies on "The Food Habits of the Introduced Toad, *Bufo Marinus*, in the Sugar-Cane Sections of Puerto Rico" (Bull. No. 74, Fourth Congress, International Soc. Sugar-Cane Technologists, pp. 6, ref. 6. San Juan, March 1 to 16, 1932) indicated that the changa constituted only 2.4% of its total food. All of these factors in natural control actually produce only a minor effect on its abundance. Artificial methods of control must be used if the farmer is to grow tobacco or vegetables on sandy land. Indeed, some land is so heavily infested with changas that no economic crop can be grown on it. Small scale experiments conducted in Georgia by Mr. W. G. Bruce (Jour. Ec. Ent., **39** (5): 662. Menasha, October 1946) indicate that such areas, at least temporarily, may be freed of the changa by applying a 1% DDT suspension in water at the rate of 5 gallons per 100 square feet. A comparable test, conducted on the lawn of the campus of the University of Puerto Rico indicated that the effect of the DDT, at least so far as the changa is concerned, lasts only about three months.

The effect of DDT is only temporary, and gradually changas tend to drift back to the treated area, so that in a few months as many may be present as before the chemical was applied. The action of chlordan and Aldrin (Hyman 118) is quite different, definitely killing the changas, which come to the surface to die, especially if rain has fallen after the application. In the morning after a rainy night, large numbers of their dead bodies will be seen on the ground, if not already picked up by chickens or insectivorous birds. Altho not all changas are killed in the first twenty-four hours, more and more die in the succeeding days as the chemical more thoroughly penetrates the soil. These chemicals have not been available long enough to indicate how long their residual effect will last, but against white grubs Aldrin shows no diminution in effectiveness after a year, and it is probable that its effect persists for a much longer period of time. Both are comparatively expensive, but they need to be used in only small amounts, as little as a pound and a half or two pounds per acre giving good results during rainy weather, with changas at the surface. Indeed, the principal difficulty in application is to spread such minute amounts of the insecticide evenly over the surface of the soil. In Florida, vegetable growers have been using enormous amounts of an inert carrier with 1% chlordan liberally applied to areas in which they expect to plant, but the same effect can be obtained with fertilizer, thus saving the expense of a separate application. Neither chemical is water soluble, but both may be obtained in technical form for mixture with fertilizer, as well as an emulsifiable concentrate or a

wettable powder. The absolute minimum amounts which can be used effectively have not been determined, but during dry weather, when changas remain deep in the earth, even excessive amounts are valueless. For use by vegetable growers, these new chemicals should entirely displace earlier methods of control of the changa, but for tobacco growers the historic method that has proved so effective in the past may be continued.

The practical method of artificial control, by making a ring around each transplanted tobacco plant of a mixture of 96 parts flour and 4 parts Paris Green, was discovered and used by Don Luis Sánchez of Comerío, quickly becoming a standard commercial practise adopted by most tobacco growers everywhere in Puerto Rico. First reported in 1915 as effective in "Control of the Changa" (S. S. Crossman & G. N. Wolcott, Circ. No. 6, pp. 3, Insular Experiment Station at Río Piedras), it was a positive means of destroying the insect, replacing mere protection of the plant at time of transplanting by wrapping with a mamey or seagrape leaf. Up to that time, this was the only method known, and indeed it is still used for the cheaper grades of tobacco. Of it, the numerous mamey trees still lining tobacco fields in the Cayey, Caguas and Comerío regions are a relic.



The changa parasite, *Larra americana* Saussure, introduced from Brasil, now established in Puerto Rico. Twice natural size. (Drawn by Francisco Seín.)

Symptomatic of the broad research basis on which the Experiment Station of the Hawaiian Sugar Producers' Association is conducted, is No. 19 of its Entomological Series Bulletins (pp. 179, fig. 16, pl. 34. Honolulu, 1928) entitled "Studies in Tropical Wasps—Their Hosts and Associates (with Descriptions of New Species)" by Dr. F. X. Williams. While searching for parasites of the oriental mole-cricket that had been

accidentally introduced into Hawaii, Dr. Williams spent some time at Belém, Pará, Brasil, and observed that *Scapteriscus vicinus* (a species which does not occur in Hawaii, and in which its sugar-producers have but the slightest interest) is parasitized by *Larra americana* Saussure. All of his observations are recorded at length, with numerous illustrations, and constitute a key for initiating a more perfect natural control of the changa in Puerto Rico. This parasitic wasp has been successfully introduced and become established in Puerto Rico, having extended its range all along the north coast and as far south as Humacao on the east and to Mayagüez on the west.

The changa is also attacked by a large yellow Tachinid fly, *Euphasiopteryx australis* Townsend, in northern Brasil, the importation of which into Puerto Rico has been attempted. Even under the most favorable climatic conditions in Brasil, however, only 2% of large changas are parasitized, indicating something of the difficulties attending such a project of parasite collection.

Brasil has giant mole-crickets, by comparison with which the inch-long changa that accidentally became established in Puerto Rico seems minute. But the changa is a giant by comparison with **Tridactylus minutus** Scudder, barely three-sixteenths of an inch long, hardly as large as some leafhoppers. Under the name *Tridactylus histrio* Saussure, Dr. Gundlach listed the Puerto Rican species, which occurs as well on Mona (Ramos), Cuba, and in México and much of the United States. Under the generic name of *Ellipes*, Dr. Wetmore records finding these little crickets eaten by the killdeer, the mangrove cuckoo and the martin. They are eaten also by the crested lizard, *Anolis cristatellus*, and the ground lizard or iguana, *Ameiva exsul*. By thousands, these little crickets may sometimes be seen making their burrows in the drying mud of ditches or along stream margins, or resting with only head and thorax exposed at the mouth of their tunnels.

Presumably they eat very small roots, but economically, any possible damage they cause is negligible.

Anurogryllus muticus (DeGeer) is a pale brown, ground cricket, which Dr. Wetmore found had been eaten by the ani, the owl, the oriole and the mozambique. It is also eaten by the crested lizard, *Anolis cristatellus*. It is normally by no means common, altho sometimes causing damage to tobacco and vegetable seed-beds. Dr. Gundlach collected specimens near Mayagüez, and Mr. J. A. G. Rehn (1910–77) found it on Culebra Island.

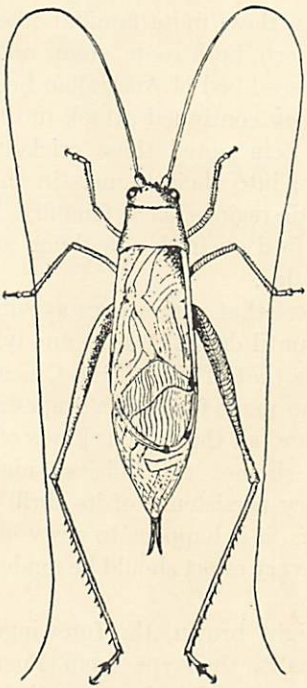
Much more abundant, somewhat larger and very much darker is **Acheta assimilis** F. Concerning this species, under the name *Gryllus aztectus* Saussure, Dr. Gundlach wrote: "Esta especie común y dañina en jardínes y huertos. De día está escondido y de noche sale a comer. Emite un

sonido fuerte en proporción al tamaño de su cuerpo, incomodando si ha llegado a un dormitorio." Dr. Wetmore found them eaten by the green heron and the ani, and Dr. Danforth by the sparrow hawk. Mrs. Dexter found them eaten by the introduced toad, but, when the food of lizards was being studied, possibly due to the accidents of collection, they were found only in the stomachs of the skink, *Mabuya sloanii*. Since these crickets cause much the same kind of damage to vegetable plants and tobacco seedlings as do cutworms and changas, it is possible that much of their injury is charged to these more familiar insects. We have definite records of attack on tobacco, both roots, stems and leaves, and on onions, beans and cotton. In a seed-bed of Australian beefwood (*Casuarina equisetifolia*) at Humacao, they continued attack until the trees had attained considerable size. Mr. Seín noted these crickets cutting off carnation flowers and pulling them into their tunnels in the ground. During dry weather, and in xerophytic regions, as at Guánica, Boquerón and on Mona Island, the crickets will feed on fresh cow dung, and hide under the slabs when they are hard and dry.

The terrific noisy racket that commences at sunset on El Yunque, and continues all night long until daylight, is as annoying to the town or city-dweller of Puerto Rico as that of the "L" in Chicago or New York to any farmer. Even in the man-made forest of a grape-fruit grove, the combined efforts of the tree-toads and all the various kinds of Orthoptera produce an overpowering din that shames the noisiest nightclub. A single tree cricket alone, by the very persistence of its shrill cry thru the night, can keep one awake for hours, if it happens to stray into town. If it happens to enter your bedroom, every effort should be made to effect its capture and silence its shrill cry.

Beautifully slender, light brown, the forewings margined with bright yellow, **Orocharis vaginalis,** the type from Puerto Rico, described by H. Saussure (*in* "Orthoptera", Biologia-Centrali Americana, p. 276. 1879) and **Orocharis terebrans** Saussure (1879–277), the type also from Puerto Rico, are the most common and representative of the tree crickets. Nymphs and adults feed on the leaves of grapefruit and coffee, making characteristic lesions along the midrib. The actual damage is negligible, and they mostly serve as nourishment for such retiring birds as the mangrove cuckoo, wood pewee and the oriole, as noted by Dr. Wetmore. On Mona Island, *Orocharis vaginalis* found a suitable environment in the rank growth of wild cotton beneath the cliffs, comparable to that on the ornamental *Dracaena fragrans*, at Río Piedras, observed by Mr. Seín. On such ornamentals, the irregular lesions to the undersurface of the leaves are distinctly detrimental, insignificant as they may be in the grapefruit or coffee grove.

The cylindrical, dark grey **Laurepa krugii** Saussure, listed by Dr. Gundlach as an *Apithis*, is scarce, but occurs in all parts of Puerto Rico, having been found in coffee groves at Adjuntas and in the mountains north of Ponce, in grapefruit grove at Bayamón, and in the mangrove swamp at Boquerón. Mr. Pedro Osuna found it a serious pest in his little coffee grove at La Muda, chewing elongate gouges in the woody stems of coffee and other plants.



Male Adult of the common Tree Cricket, *Orocharis vaginalis* Saussure, twice natural size. (Drawn by Fritz Maximilien.)

The type of **Diatrypus sibilans** Saussure, H., ("Melanges Orthopterologiques", Fasc. 6, pp. 702–703. Geneva, 1878) is from Puerto Rico, but no specimen thus identified has since been collected.

Phalangopsis guerrina Saussure is listed by Dr. Stahl.

The continental snowy tree cricket, **Oecanthus niveus** (DeGeer), was found by Prof. J. A. Ramos (1947–11) on Mona Island. This species appears to be unknown from Puerto Rico, but Mr. A. N. Caudell identified a cricket collected at Villalba as a species of **Paroecanthus.**

Hapithus tenuicornis (Walker), a xerophytic species present also in Hispaniola has short brown wings that hardly more than half cover its

darker brown abdomen. Many flew to the light on top of the Casa Grande at Hda. Santa Rita, Guánica where they were collected by Mr. E. G. Smyth.

As *Gryllodes poeyi* Saussure, Mr. James A. G. Rehn (1903–135) records **Gryllodes sigillatus** Walker, not since found in Puerto Rico, and also **Anaxipha pulicaria** Burmeister, and **Cyrtoxipha imitator** Scudder.

The very small green tree cricket, **Cyrtoxipha gundlachi** Saussure, noted by Dr. Gundlach "en las cercanías de Mayagüez", and listed by Van Zwaluwenburg, is sometimes attracted to light, but is more often noted on vegetation: sugar-cane, corn, citrus, banana and eggplant all having been noted as temporary hosts. Prof. J. A. Ramos found it on Mona Island.

Mr. A. N. Caudell identified as **Stenogryllus** a female tree cricket an inch and a half long, light purplish brown in color, collected at Aibonito in a coffee grove, and another in the rotten twig of "cobana negra" (*Stahlia monosperma*) in the swamp at Boquerón.

Moving into a house that has been vacant for some time, one will usually find that crickets have pre-empted claim to a place (not in the sun, but) in the darkness. These cave crickets, **Amphiacusta caraibea** Saussure, of which one will find the gigantic adults still living in caves in Puerto Rico and the near-by islands, seem rarely to have a chance to attain full size in houses, but the sprightly nymphs give one lots of sport, for they jump at you if you try to catch them. Dr. Roman Kenk found them exceptionally abundant in the caves at Aguas Buenas, and considers them as the most probable food for the tailless scorpions or "guabás" that inhabited the walls and ceilings. The crickets doubtlessly fed on the debris and seeds dropped by the bats after they had consumed the fleshy portions. Dull brown in color, they have the slenderest of long legs, and antennae almost twice as long: the longest antennae of any Puerto Rican insect. The short, rounded wings of the adults barely cover half the abdomen and apparently are no longer functional. In houses, the kitchen and bathroom most often harbor these crickets, and they are fond of rattling the papers in a waste-basket, especially if one has carelessly thrown the bread-wrapping and the bread crumbs there. Outdoors, they sometimes attack vegetable and tobacco seed-beds, causing damage comparable to that of the changa or the field cricket, *Acheta assimilis* F., and are to be controlled in much the same way, by the Paris Green and flour mixture. At Humacao, seed-beds of the introduced Australian beefwood (*Casuarina equisetifolia*) were attacked, injury continuing until the seedlings had begun to develop woody stems. Both Van Zwaluwenburg (1918–26) and Cotton (1918-270) discuss the economic aspects of what the latter calls the "sick cricket"—"Nocturnal in habit, hiding during the day under trash or in cracks in the soil and coming out at night to feed." Unquestionably these crickets were present

when Dr. Gundlach was in Puerto Rico, but the first mention is by Mr. James A. G. Rehn (1910-77), who collected them from caves near Pueblo Viejo and San Juan, on El Yunque, and on Culebra and Vieques Islands. They are common in the caves and in the bathrooms of the seldom-inhabited cottages on Mona Island, and have been noted in abundance hiding under coconut husks on the beach at Arecibo.

ISOPTERA: Termites

Kalotermitidae: Dry-Wood Termites

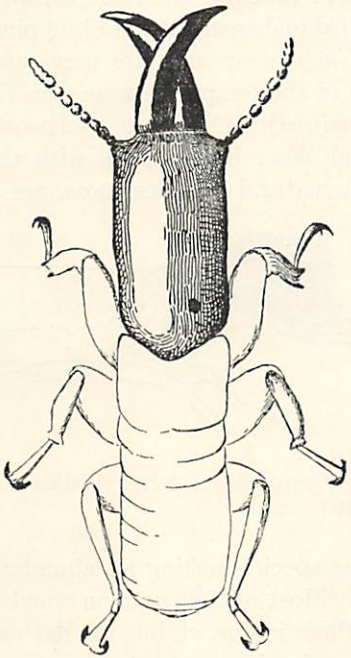
Mona Island harbors one unique endemic dry-wood termite, **Kalotermes (Neotermes) mona,** described by Prof. Nathan Banks in his "Antillean Isoptera" (Bulletin Museum of Comparative Zoology, **62** (10): 475–489, pl. 2. Cambridge, January 1919) from soldiers, which have distinct black eyes. Who collected these soldiers is not recorded, but on April 5, 1944, Jorge Serrallés and Luis F. Martorell found a colony containing winged adults in a rotten fence post, and J. A. Ramos another colony in the broken branch of "quenepa" (*Melicocca bijuga*). The colony consists of comparatively few individuals, but both soldiers and adults are of large size, exceptionally large for the West Indies. Since the winged adults have been found, Dr. T. E. Snyder was able to place the species in the subgenus *Neotermes.*

Kalotermes (K.) snyderi Light is very abundant on Mona, occurring in dead fence posts and even in the timbers of the lighthouse, but most commonly in dead branches of trees, such as seagrape or "uva de playa" (*Coccoloba uvifera*), "uvilla" (*Coccoloba laurifolia*), "sanguinaria" (*Dipholis salicifolia*), buttonwood or "mangle de botón" (*Conocarpus erecta*), milkbush or "palo de muñeca" (*Rauwolfia nitida*), and the characteristic endemic poisonwood or "papayo" (*Metopium toxiferum*). If lumber on Mona was worth anything more than for firewood, this would be a serious pest, as it is in the southeastern United States, Central America and some of the West Indies. Possibly because of competition, it is not abundant in Puerto Rico, most colonies being found in lumber also infested by other termites such as the omnipresent "polilla". The soldiers have no noticeable eyes, and the winged adults are very light-colored. The eggs are oval and whitish, the excrement pellets are barrel-shaped, with four or five darker depressions on the sides. The earlier records from Puerto Rico were reported under the name *Kalotermes marginipennis* Latreille.

One other termite present on Mona, tentatively identified by Dr. Alfred Emerson as **Kalotermes incisus** Silvestri from material collected by Prof. J. A. Ramos in August 1944, was reported by him in "The Insects of Mona Island, West Indies" (Jour. Agr. U. P. R., **30** (1): 1–74, pl. 2, ref. 45. Rio Piedras, 1947). This was originally described from Venezuela in 1903.

Since its original description by Burmeister as a *Calotermes*, the record by Dr. Stahl and the note by Dr. Gundlach: "Vive escondida dentro de las maderas muertas", **Kalotermes (Neotermes) castaneus** has not been collected in Puerto Rico.

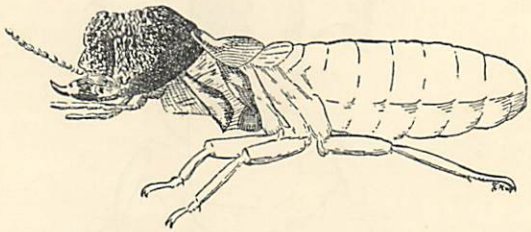
Kalotermes (K.) cavifrons (Banks), as determined by Dr. T. E. Snyder, occurs in a house on the grounds of the Experiment Station at Mayagüez, (Report for 1942, p. 14), having been first noted in 1936.



Soldier of *Kalotermes* (*K*). *snyderi* Light, ten times natural size.
(Drawn by G. N. Wolcott.)

Economically, the most important termite of Puerto Rico is the dry-wood species commonly known as "polilla de madera", or simply "polilla", and scientifically as **Kalotermes (Cryptotermes) brevis** (Walker). Its gauzy-winged, brownish adults swarm about lights in houses during May and June, and a few are to be found at any time of the year. Breaking off their wings, they pursue each other in a constantly interrupted game of "follow the leader", in which every termite wants to follow. Most of them fall prey to nocturnal lizards, or to any house-inhabiting ant, but a few crawl into crevices in wooden houses, the wooden trim in concrete houses, or burrow into furniture, the rockers of chairs, between the caning of

"solid mahogany" chairs hiding parts made of some susceptible wood, into the binding of books, or the folds of undisturbed papers or magazines, or the back of picture-frames on the wall, and there start a colony. Furniture made entirely of West Indian mahogany (*Swietenia mahagoni*) heartwood is immune to their attack, but nymphs from well-established colonies will eat deep gouges into mahogany heartwood when searching for new worlds of susceptible wood to invade, and penetrate to the outside of thin sheets of mahogany plywood. The heartwood of Honduras mahogany (*Swietenia macrophylla*) is no more resistant than the sapwood of the West Indian species, and the so-called mahogany of the Philippines (*Shorea negrosensis*), and that of Africa (*Khaya ivorensis*), are very susceptible to attack. So also are all the woods of the temperate zone thus far tested, except Osage orange (*Maclura pomifera*). Coniferous softwoods, such as southern cypress, red cedar and West Indian pine, with their heartwood heavily impregnated with their natural resinous gums, are resistant, but even the



Soldier of *Kalotenmes* (*Cryptotermes*) *brevis* (Walker). Eight times natural size. (Drawn by G. N. Wolcott.)

heartwood of the same species lacking an abundance of natural oils and gum is readily eaten. Most of the common woods of Puerto Rico are as susceptible as any of those imported, but the native hardwoods commonly used for making native furniture are almost as resistant to attack as is mahogany, and "guayacán" (*Guaiacum officinale*), "mora" (*Chlorophora tinctoria*), "maga" (*Montezuma speciosissima*), and "algarrobo" (*Hymenaea courbaril*) are even more so.

"A List of Woods arranged according to their Resistance to the Attack of the West Indian Dry-Wood Termites, *Cryptotermes brevis* (Walker)" (Caribbean Forester, 7 (4): 329–336. Río Piedras, October 1946) gives the following preferred native hardwoods in the order of their approximate desirability after mahogany: albizia (*Albizzia procera*), úcar (*Bucida buceras*), cedro hembra (*Turpinia paniculata*), cóbana (*Stahlia monosperma*), aroma (*Vachellia farnesiana*), aceitillo (*Zanthoxylum flavum*), ausú (*Amomis caryophyllata*), caracolillo (*Homalium racenosum*), ortegón (*Coccoloba rugosa*), moralón (*Coccoloba grandifolia*), guaraguao (*Guarea*

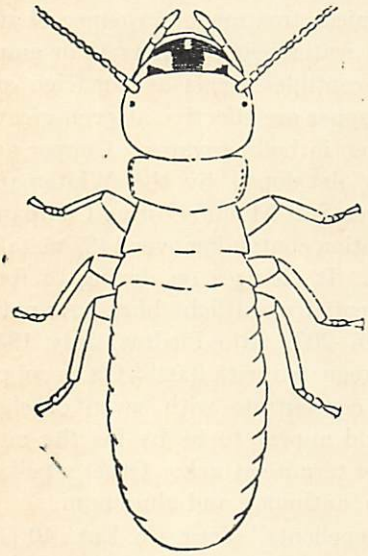
trichilioides), granadillo (*Buchenavia capitata*). The beams of capá prieto (*Cordia alliodora*) in the recently repaired Governor's palace have survived for hundreds of years without being attacked, altho controlled experiments show capá as much less desirable than mahogany, and at the very end of the list of resistant woods. Ausubo (*Manilkara nitida*), cedro macho (*Hyeronima clusioides*), cacao motillo (*Sloanea berteriana*) are susceptible woods, the one at the end of the list being laurel sabino (*Magnolia splendens*). Tabonuco (*Dacryodes excelsa*) is very susceptible, and should never be used to replace mahogany.

The outside surfaces of even the most termite-susceptible woods may be made immune to termite attack by chemical treatment; an ounce of zinc chloride or copper sulfate in a gallon of water being a more than ample concentration to protect even such susceptible woods as almácigo and flamboyán. The fluorides of zinc and copper are effective at even greater dilutions, but dissolve with difficulty, even in boiling water. Copper ammonium fluoride, $Cu(NH_3)_4F_2$, recently developed by the Whitemarsh Research Laboratories of the Pennsylvania Salt Manufacturing Company, is supplied in a concentrated aqueous solution containing over 14% metallic copper and approximately 9% fluorine. It changes on drying to form insoluble copper fluoride, staining the treated wood light blue. As noted in "The Caribbean Forester" **10** (3): 197–203. Río Piedras, July 1949, dry-wood termites will not eat wood impregnated with 0.02% Cu as copper ammonium fluoride: a dilution of the concentrate with seven or eight hundred times as much water. It would appear to be by far the most economical chemical for protection against termite attack. Other repellent metals are mercury, cadmium, ferric iron, antimony and aluminum.

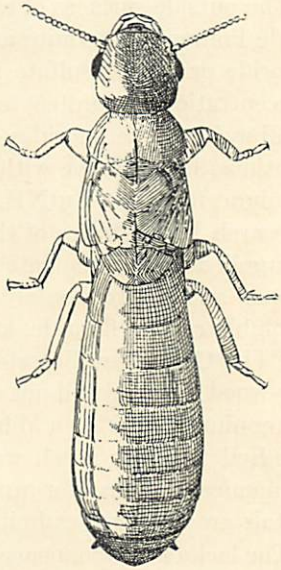
The lack of "Permanence of Termite Repellents" (Jour. Ec. Ent., **40** (1): 124-9. Menasha, February 1947) shown by some inorganic chemicals is practically universal among the organic compounds, and only time will prove which can provide protection approximating the service life of the wood anticipated where termites are not present. The lead, sodium, zinc and copper salts of pentachlorphenol are much more repellent than the widely advertized pentachlorphenol itself, as are also pentabromophenol and hexachlorphenol. The gamma isomer of benzene hexachloride is temporarily very much more effective than the alpha and beta isomers, but wood impregnated with 2% gamma isomer is eaten in less than a year while comparable samples treated with 2% DDT and 2% pentachlorphenol are still immune from attack more than six years after impregnation. Tectoquinone, present in East Indian teak (*Tectona grandis*), is not only responsible for the natural resistance to termite attack of this wood, but is available commercially for protecting susceptible woods. Xanthone and

α-Naphthoflavone are more repellent than tectoquinone. Despite the comparative inefficiency of pentachlorphenol and DDT, these two will doubtless be most extensively used in the near future, mainly because of ready commercial availability.

Some months after the male and female adult of *Cryptotermes brevis* become established in their tunnel in wood not treated to prevent their entrance, the female begins laying eggs. These are of an elongate kidney-shape, firm, plump and shining, finely reticulated and pinkish in color:



Nymph of *Kalotermes* (*Cryptotermes*) *brevis* (Walker). Eight times natural size. (Drawn by G. N. Wolcott.)



De-alate adult of *Kalotermes* (*Cryptotermes*) *brevis* (Walker). Six times natural size. (Drawn by G. N. Wolcott.)

pearly opalescent jewels of eggs. The nymph which hatches is colorless and semi-transparent, and is fed upon a blanc-mange of finely chewed-up wood, from which it graduates only gradually as it grows and moults. The moults are easily distinguished up to the fourth by progressively increasing head-sizes, and there is at least one more moult when the fully-grown nymph acquires wing-pads half the length of its body, or a very few of them moult to soldiers.

The soldiers hold the Maginot Line for the colony, inserting their head in the hole to the exterior between the intervals when the excrement pellets

are shot out of it, when the tunnels of the colony have become too crowded for comfort. These pellets are of characteristic lozenge-shape, with their two broadest surfaces slightly concave, and are as hard and dry as the wood the termites have been eating. The color varies, as colonies living in southern pine may produce some that are semi-opaque reddish-brown, while others are cream or buff. Those colonies which live in wood devoid of gum have pellets of uniform color, grey or light brown. The amount of excrement produced depends upon the palatibility or digestibility of the food: half of those woods which are high in cellulose reappearing as excrement pellets. Termites forced to eat mahogany heartwood get little nourishment out of it, 90% of the weight of the eaten wood becoming excrement, even tho less than half of it is indigestible lignin. In attaining full size, a termite nymph eats eight to ten times its live weight of wood, winged nymphs weighing approximately 0.0034 gr. each. De-alate adults weigh approximately 0.005 gr., and for maintenance alone in nine months eat six times that weight of wood.

Once established, theoretically the colony is immortal. Even if the female who founded it dies, the older nymphs take over egg-laying, their bodies becoming much distended, as hers never did. Often a colony dies out as its food supply approaches exhaustion, as in picture-frames and small articles of furniture. A building in which a colony becomes established is subject to repeated reinfestation every succeeding spring by fresh waves of adults from the original and daughter colonies, not counting all those which fly off to attack uninfested wood elsewhere. Indeed, *Cryptotermes brevis* has become so omnipresent in Puerto Rico as to be a vital factor to be considered in planning houses or purchasing furniture. "What to do about Polilla" (U. P. R. Agr. Expt. Station Bulletin No. 68, pp. 29, fig. 3, ref. 5. Rio Piedras, February 1946) is a problem facing everyone. Control in heavily infested houses or furniture is hopeless, as the wood is already so weakened by their attack as to be practically valueless, even if the termites inside it are killed. The remedy is indicated by the increasingly common use of cement construction for all permanent buildings, and of solid mahogany heartwood and similar resistant tropical hardwoods for furniture.

The high humidity and lower temperatures of El Yunque do not prevent termite attack on wooden buildings, **Kalotermes (Glyptotermes) pubescens** Snyder having been repeatedly found attacking the cottages built of native woods in the Sierra Palm recreation area, and the stumps of trees from which the timbers used in construction had been cut. This termite was originally described (Proc. U. S. National Museum, **64** (2496): 10–12, pl. 2. Washington, D. C., 1924) from a colony living in the dead top of a live coffee tree at Aibonito, and it has since been noted living in dead wood at

Cayey. The type of **Kalotermes (Calcaritermes) corniceps,** originally described by Dr. T. E. Snyder as a *Glyptotermes* (Proc. Ent. Soc. Washington, **25** (4): 91–93, pl. 1. Washington, D. C., April 1923), and most recently placed by Dr. Alfred Emerson in the subgenus **Procryptotermes,** was found in a small tree at Boquerón. It has since been collected on Mona Island, at light and a colony in an old stump by Prof. J. A. Ramos.

Rhinotermitidae: Subterranean Termites

Of subterranean termites (Rhinotermitidae), Puerto Rico has but two common species: **Heterotermes convexinotatus** (Snyder) and **H. tenuis** (Hagen). Until recently, the damage caused by them has been negligible, but in recent years has become much more serious. Colonies have destroyed an entire block of houses in Aguadilla, and the ground under the public school at Naguabo is so heavily infested that all wooden trim and cloth or paper supplies left there during vacation time is found destroyed when the school opens again. Due to heavy infestation of the ground occupied by the U. S. Naval Radio Station in Puerta de Tierra, wooden structures were replaced by new ones of concrete. The Ateneo Building in San Juan has had wooden floors repeatedly replaced, the infestation being so heavy that even the live hibiscus plants surrounding it have their wooden stems hollowed out. The most interesting manifestation is of tunnels appearing from between the ceiling and the picture molding out of cracks on the second floor of the main administration building of the University of Puerto Rico. In a country subject to earthquake shocks, even the best of present construction may develop cracks, which the lime-dissolving saliva of subterranean termites widens sufficiently so that their narrow tunnels can penetrate. From the ceiling, stalactite-like tunnels are built down to any wooden member, or to furniture resting against the wall. Of such insidious attack, not even a flight of adults gives previous warning. Since entrance in large buildings is within the walls, or inside the building, the efficient application of chemicals, such as sodium arsenite, or coal-tar creosote, or pentachlorphenol, or fumigants such as orthodichlorbenzene or chlorpicrin, is much more difficult than in buildings that have a basement. When the termites gain entrance to a concrete building in which wooden members extend thru the floor to the earth beneath, the removal of such structural means of easy approach should eliminate the infestation. All weaknesses and deficiencies in construction are discovered by the termites, which may repeatedly gain entrance to buildings, as in the School of Tropical Medicine at San Juan, around water mains or pipes, ground wires, or even in the corners of dark closets imperfectly floored with tile. For a building in infested areas, construction must be comparable to that of the hull of a boat, if entrance of these most persistent termites is to be prevented.

Soldiers of **Prorhinotermes simplex** (Hagen), as identified by Dr. T. E. Snyder, were discovered by Mr. Francisco Seín in August 1944 at Río Piedras in breaking open a "comejenera" of *Nasutitermes costalis* on a living aguacate tree. When this nest was removed, many additional soldiers and workers were found in the rotten wood. The slender, curved jaws of the soldiers, with smooth, un-toothed margins, are very different from the powerful jaws of the soldiers of *Heterotermes*.

Tenuirostritermes discolor was described by Prof. Nathan Banks (1919-489) as a *Constrictotermes* from soldiers taken at Manatí, Adjuntas, El Yunque and on Culebra Island, and it has since been found in rotten palm stump at Guavate Camp, Cayey and in rotten stump or trunks of *Inga vera* in coffee groves at Ciales and Lares. No external nest is constructed, but the interior of a rotten stump is hollowed out and lined with very dark brown termite building material, runways extending to other parts of the tree trunk under the bark. It is one of the more common termites of the coffee groves and high mountains, attacking trees that are entirely dead, and not the dead and dying portions of live trees, as does *K.* (*Glyptotermes*) *pubescens*.

Tenuirostritermes wolcotti is a "small, dark species, with a hairy, fairly prominently constricted head" of which Dr. T. E. Snyder wrote the "Description of a New Termite from Puerto Rico" (Proc. Ent. Soc. Washington, **26** (5): 131–2, fig. 1. Washington, D. C., May 1924) from material found at Boquerón in dead wood of "úcar," *Bucida buceras*, November 7th, 1923. No nest was present, but tunnels sometimes as much as an inch in breadth extended up from the ground over the dead wood. They were constructed almost entirely of reddish soil, with apparently little organic content. No subsequent collection of this termite has been made in Puerto Rico or elsewhere.

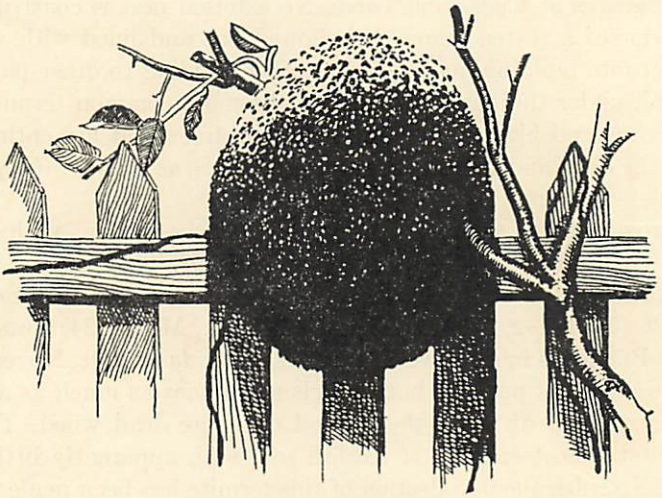
Microcerotermes arboreus Emerson (as *Eutermes debilis* Heer) "was described from specimens in gum-copal and Hagen identified it with specimens from Porto Rico" according to Prof. Banks (1919–482), the material having been collected by Dr. Gundlach and listed by him and Kolbe. It has not since been found locally. Prof. Banks states that "doubtless *Eutermes theobromae* Desneux, from St. Thomas, is the same species."

Termitidae

The large aerial "nigger-head" nests or "comejeneras" to be seen on dead fence posts, or on live trees along highways, especially on flamboyáns, are the most typical expression of the activities of the most common representative of the Termitidae in Puerto Rico: **Nasutitermes (N.) costalis** Holmgren (= *N. morio* Latreille, = *N. sanchezi* Holmgren). This is the cosmopolitan species present in all the larger West Indies, but is not known to occur on Mona, Desecheo or Culebra. Near Pt. Arenas, Vieques

Island, an exceptionally large "comejenera" was observed in 1940, and for many years one almost as large survived on a mamey tree close to the road at Martín Peña. They rarely attain large size in the more densely inhabited parts of Puerto Rico at the present time, furnishing a too tempting target for boys with stones, and farmers cut them down to furnish animal food for chickens.

On some breathlessly hot late afternoon or early evening, just before the approaching storm breaks in May or June, thousands of black winged adults crowd out of the nest. Lizards soon tire of the feast they provide, but ants seem unwearying in returning to the attack. The cook fumes be-

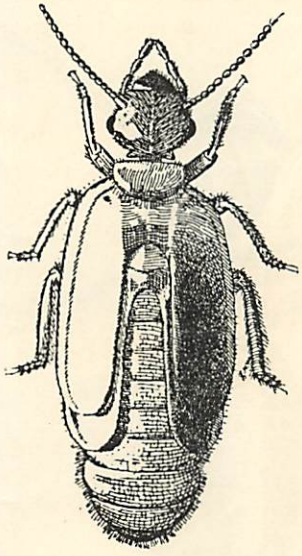


"Nigger-head" nest, or "comejenera" of *Nasutitermes* (*N.*) *costalis* Holmgren. (Drawn by G. N. Wolcott.)

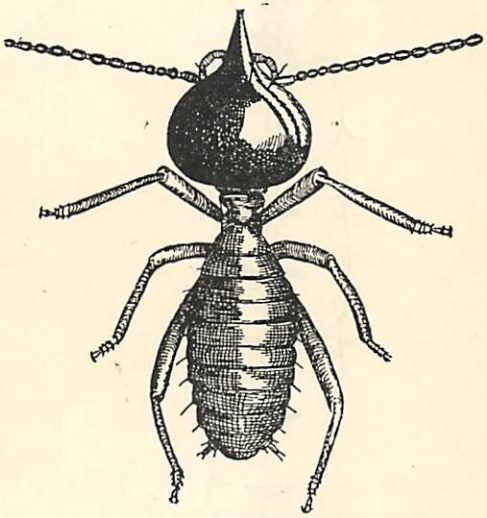
cause they fall into whatever she holds near the light, and dinner is eaten in semi-darkness, if one is to avoid fishing numerous helpless bodies and detached wings out of the soup. No urge to survive seems to animate the adults, and, judging by the number of new nests each year, less than one in a million escapes the numerous perils besetting them. The evidence as to how a new colony is started is based on finding in a rotten twig of "achiote" (*Bixa orellana*) at Lares in mid-June 1921, four de-alate adults, and on May 23, 1923, one de-alate adult in a cavity in the dead branch of a coffee tree at Indiera.

Despite the common occurrence of nests on live trees, the "comejéns" do not attack any living portion of the tree. Tracing their tunnels to the end, one invariably finds a dead branch or dead wood. While the termites

remain exclusively within their nest and tunnels during the daytime, at night they make sorties by means of which they locate a fresh supply of food, and construct a covered tunnel to it before the sun discovers them. They are remarkably persistent in continuing to repair a broken tunnel when it leads to food, but a piece of wood inserted in the nest is walled off and ignored. While flamboyán trees seem to be preferred on which to construct nests and tunnels, the species of trees infested approximate all those occurring in coastal Puerto Rico, including even mahogany. When com-



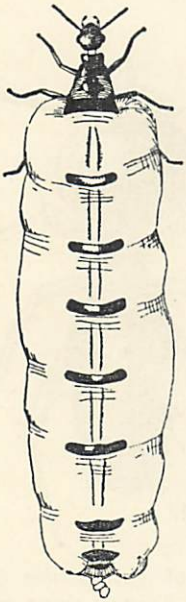
Nymph of *Nasutitermes* (*N.*) *costalis* Holmgren. Ten times natural size. (Drawn by G. N. Wolcott.)



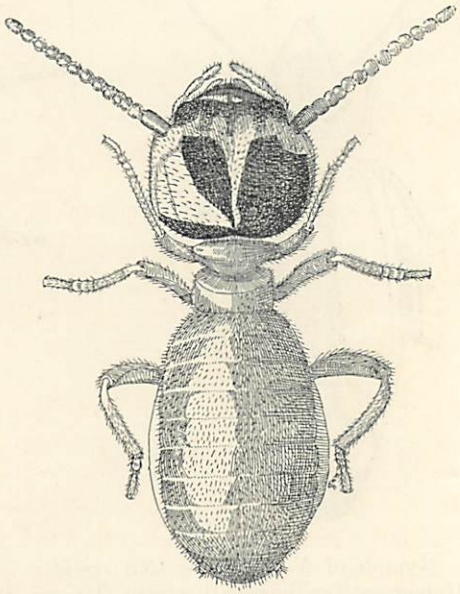
Soldier of *Nasutitermes* (*N.*) *costalis* Holmgren. Twenty times natural size. (Drawn by G. N. Wolcott.)

mencing his work towards a doctorate thesis, Dr. Luis F. Martorell (Caribbean Forester, **2** (2): 80–82. New Orleans, January 1941) observed 84 species of trees attacked. Every kind of dead wood is attacked, including even swamp-cured mangrove (or úcar), an arbor of this in the Station grounds at Río Piedras showing how both arbor and supporting vines are eaten. A manufacturer of concrete arbors imitating rustic wood, to increase their similitude, included a comejenera of concrete. The "comején" is a really serious pest in cut-over mangrove swamps, where so much of the decaying stumps are eaten that new shoots have difficulty in getting started. Attempts to drown out the termites by cutting stumps so low that they will be covered at high tide have not been notably successful, the

use of finely powdered Paris green (a table spoonfull in the top of the broken-open nest), elsewhere so successful in control if used during dry weather, failing because the moistened powder cakes and does not adhere to the bodies of the termites. Breaking open a comejenera, or any of the tunnels of carton from it, one first sees the clumsy, big-headed nymphs retreating before the light of day, and then, promptly coming up to defend the colony, the much smaller soldiers with their dark brown heads with elongated beak or "nasutum" in front. From this is ejected a sticky, stink-



Ovipositing queen of *Nasutitermes* (*N.*) *costalis* Holmgren, four times natural size. (Drawn by G. N. Wolcott.)



Worker of *Nasutitermes* (*N.*) *costalis* Holmgren, about twelve times natural size. (Drawn by G. N. Wolcott.)

ing fluid that is sufficiently unpleasant on your hands, and is entirely effective in gumming up and driving away such smaller enemies of the termites as ants. Thousands of these soldiers are soon mobilized at the point where nest or tunnels have been broken open, and they run wildly about outside in search of the cause of the disturbance. If nothing more happens, they gradually concentrate where the break occurred, and guard the nymphs coming up to make repairs. The fat, transparent abdomens of the nymphs, distended with partly digested food and excrement plainly visible, provide the building material with which the thin wall of the nest or tunnel is

quickly extended, so that in surprisingly short time the roof is again complete. One sees only a multitude of soldiers standing guard, and the head and then the rear end of one of a steady procession of nymphs coming up to make its contribution to the wall of excrement, which dries to form carton. Actually, the nymphs are much more numerous than the soldiers, and in a large nest must number millions, all brothers and sisters, with (normally) but a single male and female parent. The male is no larger than when he started the colony with his mate, and is lost in the immensity of the number of his progeny. The queen, mother of millions, has developed an enormously distended abdomen almost as large as the last two joints of your little finger. She lives walled in by thickened carton in a spacious chamber low down towards the center of the nest, continually surrounded by large numbers of her sons and daughters engaged in massaging the royal maternal hide, and carrying away the eggs that emerge in a steady stream from her rear. Her only function is to eat copiously the food supplied her that there may be no slackening in egg production, as the worker nymphs promptly assume all care of the eggs and the nymphs hatching from them. Stored in adjoining chambers until the eggs hatch, the baby nymphs are fed and cared for by their nurses until they attain sufficient size to undertake their share of the duties of the workers in the colony.

The nasuti soldiers are always soldiers to the end of their existence, and very brave and fearless they prove to be in any ordinary crisis. Most of the nymphs, also, retain permanently their workers status, but some of them, possibly because they have been fed a different food, eventually develop wing-pads, and at the next moult the fully-expanded wings of adults. At first these are waxy white, but before the adults are ready to emerge from the nest, their wings have become blue-black and their bodies are brown and tough.

The adults of what Prof. Nathan Banks described as **Nasutitermes creolina** from Trinidad, St. Thomas, Vieques and Puerto Rico, are more yellowish, smaller and with smaller eyes. The soldiers are reddish-brown, with a shorter nasutum, and "hairy all over". A comejenera of this species on an "algarrobo" (*Hymenaea courbaril*) in the margin of a coffee grove near Río Piedras was light brown in color, the outside layers being of a uniform brittle character, but the interior layers very hard and tough, containing many hard balls about an inch in diameter, with two or more narrow tunnels leading to the interior. The exterior tunnel to the ground was nearly an inch broad. Only workers, nasuti and immature stages were found, July 8, 1921; the workers bit viciously.

Considering the specific name given by Holmgren to his *Nasutitermes costaricensis*, it seems doubtful that this species occurs in Puerto Rico.

The absence of soldiers or adults in colonies of a species of **Anoplotermes** found living in the earth around roots of a Bougainvillea vine on the Seín farm, Pueblo Viejo in September 1933, made specific determination impossible. "The colonies contained large numbers of very pale minims, some partly grown nymphs, others larger, with abdomens largely filled with earth particles, the largest individuals with yellowish wing-pads having very heavy, elongate abdomens, easily crushed, with a very tender, thin, transparent skin, containing root tissues in the process of digestion", according to Mr. Francisco Seín, who discovered them.

EMBIDIINA

In "A Revision of the Embioptera, or Web-Spinners, of the New World" (Proc. U. S. Nat. Mus., **94** (3175): 401–504, pl. 2. Washington, D. C., 1944), Edward S. Ross records three endemic species of Embiids from Cuba, two from Hispaniola, one from St. Croix and four from Trinidad. The only species to date collected in Puerto Rico is **Oligotoma saundersii** (Westwood), noted by Dr. Gundlach and Kolbe as *O. cubana* Hagen, and listed more recently as *O. latreillei* (Rambur), all names referring to a single species originally described from India. It is, according to Dr. Ross, "artificially tropicopolitan; in the New World, widespread from Texas, Florida, West Indies and México to temperate South America, found especially near cities and towns". Even on nights when no other insects are attracted to lights at Río Piedras, sometimes a single adult will appear. Dr. Gundlach gives no localities of collection, but presumably his specimens were from Mayagüez, where recent collections have been made (Ramos), or at Bayamón, and the species was doubtless widely distributed on the Island even at the time he was here. In addition to the adults attracted to lights, a small colony was found by Prof. J. A. Ramos in a hollowed stem of "escambrón" (*Randia mitis*) at Guanajibo Beach, Mayagüez, December 1944. Careful search on orchids or bromeliads from El Yunque might yield one or more endemic species to match those from the other West Indies.

CORRODENTIA

The cosmopolitan cereal Psocid or "booklouse", **Liposcelis divinatorius** (Müller), a small, wingless, active, light or dark brown insect not more than a millimeter in length, may at times become very common in favorable environments. Dr. Stuart T. Danforth found them a serious pest in imperfectly preserved bird-skins. They have been repeatedly identified by Prof. Nathan Banks from colonies of dry-wood termites left uncared-for in petri dishes, where they jostle the living termites and feed on the dead ones, leaving a fine powdery brown excrement. They can

hardly be considered beneficially symbiotic, for the termites tend to die with increasing rapidity when the Psocids become established in these artificial colonies. They have not been observed in normal "polilla" colonies in wood, but in articles of furniture so nearly destroyed by termites that little remains for them to devour, the Psocids and silverfish can hardly be kept out. This Psocid has been recorded in Puerto Rico attacking dried stored cacao beans, but it presumably occurs on many other stored food products, especially those allowed to remain too long undisturbed in dark warehouses.

What Prof. Nathan Banks described under the name of *Pseudocaecilius wolcotti* (Mus. Comp. Zool. Bull., **65** (12): 423. Cambridge, 1924), collected in Puerto Rico from the underside of palm fronds and bucare leaves, is considered by Dr. Paul J. Chapman, after a study of the paratypes, ("Corrodentia of the United States of America", Jour. N. Y. Ent. Soc., **38** (3 & 4): 219–403, pl. 9. New York, 1930) to be the widely-distributed **Pseudocaecilius pretiosus** Banks, common on citrus trees in Florida, and collected in Texas, and in greenhouses in Washington, D. C. When Dr. Luis F. Martorell was making an intensive study of the insects of forest trees, he collected Psocids from the underside of the leaves of numerous kinds of trees, but all proved to be inhabited by this single species. It makes silken nets or tents, under which may be found both nymphs and adults, their bodies a dull light yellow, their eyes chestnut-brown, the wings of the adults spotted with black. One may presume that they are scavengers on the remains of other insects, for a few and sometimes many mealybugs or scale insects also often occur under the same shelter, but hardly in sufficient abundance to feed many Psocids. They have been noted on El Yunque, and on the beach at Mameyes, and at Salinas, Yauco and Guánica, apparently thriving under all climatic conditions present in Puerto Rico.

Caecilius olitorius, described by Prof. Nathan Banks (Mem. Soc. Cubana Hist. Nat., **15** (4): 385–402, pl. 2. Habana, December 1941, see p. 389) from two yellow and brown specimens collected by Dr. P. J. Darlington on El Yunque, is known only from the types.

Ectopsocus pumilis (Banks) was identified by Dr. A. B. Gurney as the Psocid which Dr. Donald De Leon found under the leaves of "cacao motillo" (*Sloanea berteriana*) at Guavate Camp, Cayey. **Ectopsocus ribagai** Enderlein was found in the decayed flower stalk of a banana at Bayamón. The Psocids infesting the casein-wash walls of the School of Tropical Medicine, collected by Dr. W. A. Hoffman, proved to be a species of **Ectopsocus.**

Embidipsocus lutens Hagen has been found in cereal.

Lachesilla pedicularia (L.) has been found among the seeds and dried leaves of lettuce.

Even the largest nest or tent on the underside of leaves constructed by *Pseudocaecilius pretiosus* is insignificant by comparison with some that are at times noted covering the trunks of large trees from the ground up to where the main limbs branch out. In one examined in Guajataca Gorge, no live insect was present towards the base of the tree, all rapidly retreating to the upper trunk, where they could not be reached. It is possible that this species is represented among those intercepted by the Federal Plant Quarantine inspectors while scouting for fruitflies in grapefruit groves: **Polypsocus fasciatus** Banks at Bayamón and at Manatí, **Archipsocus brazilianus** Enderlein at Garrochales, and others to which Mr. A. N. Caudell did not assign specific names; **Deipnopsocus** at Arecibo, **Epipsocus** at Bayamón, **Nepticulomima** and **Psoquilla** near **termitorum** Townsend at Palo Seco.

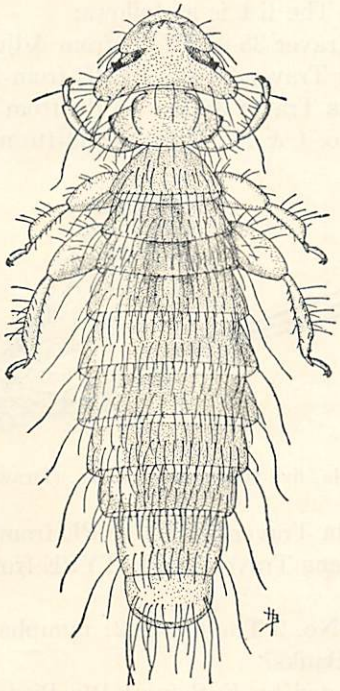
MALLOPHAGA

Most species of the biting bird lice are of cosmopolitan distribution, and occur wherever their specific or similar hosts are to be found. The kangaroo louse, **Heterodoxus longitarsus** Piaget (Boopidae), of which the original host is the kangaroo, also occurs on dogs in as widely separated localities as South Africa, California, and Puerto Rico. It was first collected here by Dr. W. A. Hoffman, and to his industry, and that of Dr. H. L. Van Volkenberg, are due most of the records of bird lice on domestic animals. Guinea pigs in captivity are host of both **Gyropus ovalis** Nitzsch and **Gliricola porcelli** L. (Gyropidae). The common hen louse, **Menopon gallinae** L., and the large body poultry louse, **Eomenacanthus stramineus** Nitzsch, (Menoponidae), are common on chickens and turkeys in Puerto Rico, and on guinea fowl Dr. Hoffman found **Menopon numidiae** Giebel.

Wild birds are hosts for a much greater number of kinds of lice, and local records depend entirely upon the collecting of Dr. Stuart T. Danforth and determinations by Dr. H. E. Ewing. Shore birds are host to undetermined species of **Menopon, Actornithophilus** and **Heleonomus. Menacanthus chrysophaeum** Kellogg and **Myrsidea incerta** Kellogg infest the kingbird, besides four other species of bird lice. **Colpocephalum flavescens** Nitzsch, elsewhere found on eagles, in Puerto Rico lives on the antillean sparrow hawk, and the pearly-eyed thrasher. The "rabijunco" or frigate bird, *Fregata magnificens*, is host to **Amyrsidea aurifasciatum** Kellogg, collected on Mona Island by Dr. Luis F. Martorell in August 1939, as identified by Dr. Ewing. Undetermined species of **Colpocephalum, Myrcidea** occur on various song birds. **Ricinus invadens** Kellogg (Ricinidae) infests warblers and reinitas, and an undetermined **Ricinus,** larger song birds.

The biting goat louse, **Trichodectes (Bovicola) caprae** Gurlt, (Tricho-

dectidae), has been found on goats and cattle, and **Trichodectes (Felicicola) subrostrata** Nitzsch on cats. The lesser chicken louse, **Goniocotes hologaster** Nitzsch (Philopteridae) and **Goniodes dissimilis** Nitzsch also occur on chickens in Puerto Rico, and **Goniodes meleagridis** L. on turkeys. Turkeys are also host for **Lipeurus gallipavonis** Geoffroy, chickens for **Lipeurus caponis** L., guinea hens for **Lipeurus numidiae** Denny, and on the pearly-eyed thrasher an undetermined **Lipeurus. Philopterus quiscali** Osborn infests grackles, and **Philopterus subflavescens** Geoffrey was col-



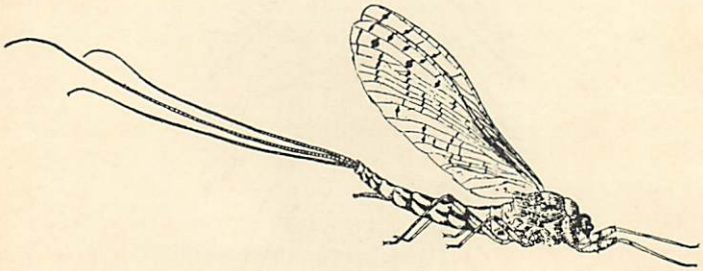
Male of *Eomenacanthus stramineus* Nitzsch. Greatly enlarged. (After Bishopp.)

lected from doves, mockingbirds and thrashers by Dr. Danforth. Grackles are also infested by **Degeeriella illustris** Kellogg, the mockingbird by **Degeeriella eustigma** Kellogg, a sandpiper by **Degeeriella complexiva** Kellogg & Chapman, while undetermined species of this genus were found on kingbirds and on various shore birds. The frigate bird is host to **Esthiopterum gracilicornis major** Kellogg, and other species of **Esthiopterum** were found on grackles, blackbirds and the kingbird. The kingbird is also host to a **Physconelloides** and a **Columbicola,** as are also doves, hawks, and warblers to other species of these genera.

EPHEMERIDA

Everything that is known about the "Mayflies of Puerto Rico" is in the paper by Dr. Jay R. Traver (Jour. Agr. Univ. P. R., 22 (1): 5–42, pl. 3, ref. 23. Río Piedras, April 15, 1938), based on the collections made by Dr. Julio García-Díaz and Prof. James G. Needham. Only a single species, **Callibaetis completa** Banks, described from Cuba, occurs elsewhere. Nine new species, mostly from El Yunque and the Luquillo Mountains, are described, and seven others, represented only by nymphs, are indicated as being present here. The list is as follows:

Neohagenulus julio Traver 38-9: TYPE from Adjuntas, P. R.
Neohagenulus tinctus Traver 38-12: TYPE from Luquillo Mts., P. R.
Neohagenulus luteolus Traver 38-13: TYPE from Luquillo Mts., P. R.
Neohagenulus spp. No. 1 & No. 2 Traver 38-16: nymphs.



A Mayfly from Hispaniola, five times natural size. (Drawn by F. Maximilien).

Borinquena carmencita Traver 38-18: TYPE from El Yunque, P. R.
Borinquena contradicens Traver 38-20: TYPE from La Mina, El Yunque, P. R.
Caenis spp. No. 1 & No. 2 Traver 38-22: nymphs.
Callibaetis completa Banks?
Traver 38-24: collected by F. Seín at Río Piedras.
Callibaetis sp. Traver 38-25: nymphs, possibly *C. completa.*
Baëtis garcianus Traver 38-26: TYPE from Río Tanamá, P. R.
Baëtis spp. No. 1 & No. 2 Traver 38-28, 29: nymphs.
Cloëodes maculipes Traver 38-33: TYPE from Luquillo Mts., P. R.
Cloëodes portoricensis Traver 38-36: TYPE from Lares, P. R.
Cloëodes consignatus Traver 38-37: TYPE from Río Yúnez, P. R.

ODONATA

A few of the more common dragon flies were collected by Drs. Gundlach and Stahl, and named for them by Herr Hermann Julius Kolbe, being listed by him in "Die geographische verbreitung der Neuroptera und Pseudoneu-

roptera der Antillen, nebst einer ubersicht über die von Herrn Consul Krug auf Portorico gesammelten Arten" (Archiv. für Naturgeschichte, 46th year, **1** (2): 153–178, pl. 13, fig. 11. 1888). Dr. Root in his notes on blood-sucking flies records the capture of a deerfly, *Chrysops costatus* F. by *Lepthemis vesiculosa* F. at Aguirre, but the first intensive study of them dates from the paper, "Odonata or Dragon Flies", by Mrs. Elsie Broughton Klotz in the Scientific Survey of Puerto Rico and the Virgin Islands, **14** (1): 1–107, ref. 95, published by the New York Academy of Sciences in 1932. In "An Ecological Survey of the Fresh Water Insects of Puerto Rico, I. The Odonata: with new Life-Histories" (Jour. Agr. Univ. P. R., **22** (1): 43–97, pl. 8, ref. 44. Río Piedras, April 15, 1938) Dr. Julio García-Díaz presents the results of the rearings, collecting field trips and systematic observations made with Dr. James G. Needham. These cover only Puerto Rico proper, but Dr. Needham has identified three dragonflies collected since on Mona Island by Luis F. Martorell as *Orthemis ferruginea* (F.), *Erythrodiplax umbrata* (L.) and *Enallagma civile* Hagen.

Aeschinidae

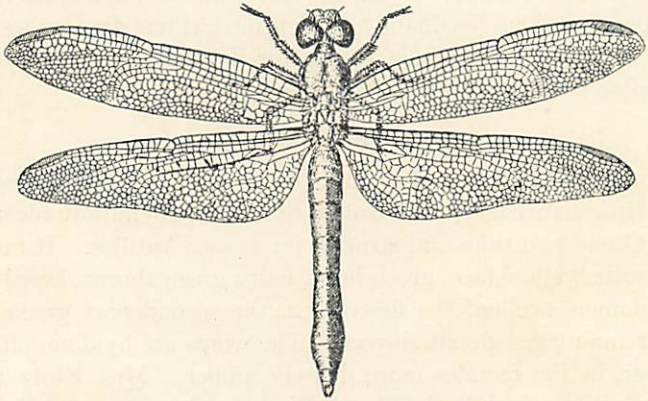
Anax junius (Drury) is a very large, cosmopolitan dragonfly, common in Asia, the Hawaiian Islands, the United States, and definitely recorded from all of the Greater Antilles and some of the Lesser Antilles. It may be recognized by the yellow face, green head, hairy green thorax, basal segments of the abdomen swollen, the first green, the second part green and part blue, the remaining segments brown. The wings are hyaline, often tinged with amber, in the females more densely amber. Mrs. Klotz (1932–16) records collection of adults in Puerto Rico at Aibonito and Adjuntas, and by Don Julio García-Díaz, when a student, on the night trains between Río Piedras and Mayagüez. Prof. James G. Needham noted that the nymphs are "notoriously cannibalistic", which Don Julio thinks (1938–56) as "possibly accounting for the very few reaching adult stage. Although not very often seen, the adult is to be found throughout the entire year and from sea level up to 2,000 feet. Most easily caught when copulating because when doing so the pair usually rests along the shore of the pond." He records numerous collections of adults: from La Muda to Cabo Rojo, and of nymphs from Tortuguero and Cartagena Lagoons. "In the Yúnez River in the gorge above the bridge on Km. 19.6, I have seen the big *Anax*, together with some swallows, early in the morning, flying up and down the river and feeding on the adult mayflies dancing in the air about 30 to 40 feet above."

Anax amazili (Burmeister) has not been found as an adult in Puerto Rico, the record of occurrence being based on two nymphs collected by Don Julio in Hato Rey at Stop 30, in a pool of clear water, not over three

feet deep, temporary even at that time, and since eliminated by construction.

Aeschna (or *Aeshna*) **cornigera** (Brauer) has been found as an adult in Puerto Rico but once, at Adjuntas, but nymphs found by Prof. James G. Needham at Camp Buena Vista, Maricao Forest, at an elevation of 2,350 feet, may be this species.

Coryphaeschna adnexa (Hagen), described from Cuba and ranging from Mexico to Brasil, is comparatively rare as an adult in Puerto Rico, but the white-eyed nymphs were found in abundance by Don Julio (1938–57), quite as common as those of *Anax*, "on the west end of Lake Tortuguero among *Polygonum* plants in standing water about two and a half feet deep".



Adult of *Orthemis ferruginea* (Fabricius), natural size. (Drawn by Fritz Maximilien.)

Acanthagyna nervosa Rambur adults were collected by Don Julio (1938–85) in the completely dry west end of Tortuguero Lagoon, late in the afternoon of October 31, 1937, flying close to the ground among clumps of grasses. As a *Gynacantha*, Kolbe (1888–168) had identified adults collected by Dr. Gundlach and listed by him from Puerto Rico.

Gynacantha trifida Rambur records for Puerto Rico are based on collections by Drs. Stahl and Gundlach, identifications made by Herr Kolbe.

Libellulidae

Orthemis ferruginea (Fabricius), listed from Puerto Rico as *Orthemis discolor* Burmeister by Drs. Stahl and Gundlach, as identified by Herr H. J. Kolbe, is a common, bright red dragon fly with brown veins and stigma on hyaline wings. Despite an extended distribution in the southern United States from Florida to Arizona, and south to Chile, and in prac-

tically all of the West Indies, including Mona Island, no collection has been made in Puerto Rico west of Isabela on the north coast, or west of Juana Díaz on the south coast, despite numerous records in eastern Puerto Rico.

Perithemis domitia (Drury), first reported from Puerto Rico by Drs. Gundlach and Stahl as *Libellula metalla* Selys, is rarely seen as adult, "due to their sensitiveness", according to Don Julio (1938–63) "to bright, shiny, or cloudy damp days". Described from Jamaica, the species seems restricted to the Caribbean area and México. Females have not been found in Puerto Rico, altho Don Julio reared many, in proportion to males, from nymphs taken from a sink-hole pool at Isabela. Males were collected in the field by Prof. Needham at Río Piedras and at Cabo Rojo.

Miathyria marcella Selys, originally described from Cuba, has been found in Puerto Rico only in the northern coastal plain of the Island, according to Don Julio (1938–62).

Micrathyria aequalis Hagen, as identified by Prof. James G. Needham, was collected by him and Don Julio along an irrigation ditch north of Cabo Rojo. Prof. Needham found this dragon fly very abundant at Soledad, Cuba, in May, 1937, where "it swarmed about the edges of the big pond in the botanical garden and in two lesser ponds outside the garden", as reported in "Life History Notes on *Micrathyria* (Odonata)" (Annals Ent. Soc. America, **36** (2): 185–189, fig. 1. Columbus, June 1943). He observed oviposition, and estimated 2000 eggs were laid at one time, from which a reared nymph was described.

Micrathyria didyma didyma (Selys) has not been found in Puerto Rico since collection by Dr. Gundlach, reported as *Dythemis dicrota* Hagen, as identified by Herr H. J. Kolbe, and thus listed (1888–168) by him.

Micrathyria dissocians, described by Prof. Philip P. Calvert ("Odonata" in Biologia Centrali-Americana. Neuroptera, pp. 17–420, pl. 9. London, 1901–8., see pp. 222–6), the type from Mayagüez, P. R. and Vera Cruz, México, is "apparently confined to the coastal plain" according to Don Julio (1938–63), collections having been made at Río Piedras, Vega Baja, Manatí, Caño Tiburones and from Cartagena Lagoon.

Micrathyria hageni Kirby is reported from Puerto Rico by Kolbe, according to Mrs. Klotz (1932–41). Prof. Needham (1943–185) found the nymphs in abundance in Santo Domingo, from which he prepared an illustrated description.

Erythrodiplax umbrata (Linnaeus), a very common, cosmopolitan dragonfly, with a range from the southern United States to the Argentine, was first reported from Puerto Rico as a *Libellula* by Kolbe (1888–167) from material collected by Drs. Gundlach and Stahl, and subsequently by Prof. Calvert and Mrs. Klotz. In addition to material collected by Dr. Luis F. Martorell on Mona Island, identified by Prof. Needham, Dr. D. J.

Borror in "A Revision of the Libelluline Genus *Erythrodiplax* (Odonata)" (pp. 286, pl. 41. Columbus, 1942), also lists it from Vieques Island.

Erythrodiplax connata connata (Burmeister) is thought by Dr. Borror (1942–173) to be the correct name for what Kolbe (1888–169) described as *Diplax portoricana* from the material collected by Dr. Gundlach, and what Mrs. Klotz (1932–45) called *Erythrodiplax miniscula* (Rambur). Don Julio (1939–60) collected it only from the Cartagena Lagoon, and notes that it is not common.

Erythrodiplax naeva (Hagen) is the name given by Dr. Borror (1942–93) for what Mrs. Klotz (1932–46) records as *E. bernice naeva* (Hagen), based on adults from San Juan and Santurce.

Erythrodiplax justiniana Selys is what Dr. Borror (1942–155) thinks is what Herr Kolbe (1888–168) reports as *Diplax ambusta* Hagen, collected by Dr. Gundlach, and of which Mrs. Klotz records numerous collections under the name *E. connata justiniana* Selys. Don Julio (1938–59) found adults "most abundant in swampy places usually with a lot of vegetation, but they occur also along the rivers. They are fast fliers and their direction of flight is erratic. They fly low and seldom stand on the higher plants, preferring the lower ones, usually selecting new perching places every time. Once having located a place where they occur, one is sure to get a good series since they keep close to the place even if many times disturbed". Adults have been found in all parts of Puerto Rico, in the mountains as well as along the coastal plan, but most often at elevations for 1,000 to 2,000 feet.

Brachymesia furcata Hagen, as determined by Prof. James G. Needham, was collected by him, April 5, 1930, near the reservoir at Coamo Springs.

Cannacria herbida (Gundlach), listed as a *Brachymesia* by Mrs. Klotz (1932–51) from the north coast of Puerto Rico, was found by Don Julio (1938–58) "to be restricted to the coastal plain, where adults are quite common throughout the year. Usually they select a stick over the surface of the water where they perch persistently and to which they return after repeated disturbances". Nymphs were found in great abundance close to the shore of Cartagena Lagoon, August 10, 1937.

Erythemis plebeja (Burmeister) was reported by Mrs. Klotz (1932–55) from Ponce and Arecibo. Don Julio (1938–59) has many records, but found it "one of the most difficult dragonflies to obtain because of its alertness and swift flight, and also because it usually chooses open spaces for perching where it is difficult to catch".

Lepthemis vesiculosa (Fabricius) is a large green dragonfly, with unmarked hyaline wings "with the merest touch of yellow at the base of the fore wing", reported by Herr Kolbe (1888–168) from collections made by Dr. Gundlach. It was this dragonfly that Dr. F. M. Root (1922–405) ob-

served capturing a deerfly, *Chrysops variegata* DeGeer, at Aguirre. Don Julio (1938–54) observed that in February and March at Tortuguero Lagoon, these dragonflies "were attacking the small white swamp moths, *Nymphula fluctuosalis* Zeller, which were then very abundant. These moths flew very low over the water surface, among the emergent aquatics, and so were in part protected from *Lepthemis*". It is "one of the most common, if not the commonest, species on the Island. Adults fly tirelessly along the open waters, keeping most of the time close to the shore. They may be exceedingly common, and yet few cast skins may be found. The nymphs live in pools and standing waters, but also in running water, since in 1930 Doctor Needham collected numerous nymphs among algae mats growing in the shallow Coamo River back of Coamo Spring hotel. The highest altitude record is 1,800 feet", according to Don Julio, altho Dr. Richard T. Cotton noted adults abundant in a swampy field near a woods at Aibonito at a somewhat higher elevation. Collected from Las Cabezas to Cabo Rojo in Puerto Rico, and in all the islands of West Indies, this cosmopolitan dragonfly is known from Florida and Texas in the United States, south to Paraguay.

Macrothemis celeno (Selys), identified for Drs. Stahl and Gundlach as *Dythemis pleurostictia* Hagen by Herr Kolbe (1888–168), was originally described from Cuba and has a rather limited distribution in the Greater Antilles and the Virgin Islands. In Puerto Rico it has been extensively collected from sea level to above 2,000 feet, and Don Julio (1938–62) found it "most common and easily seen along the water courses in the high levels. The nymphs in the rivers are found among overhanging roots and stems of plants growing close to the edges. The adults fly along the rivers and usually come to rest on gravel or stones".

Dythemis rufinervis (Burmeister) was identified by Herr Kolbe (1888–168) from collections made by Drs. Stahl and Gundlach: another dragonfly of distribution limited to the Greater Antilles and the Virgin Islands. In Puerto Rico it is found up to elevations of 2,000 feet, the nymphs in mountain rivers as well as in Cartagena and Tortuguero Lagoons. Don Julio (1938–58) notes that "the adults are twig perchers. Once they select a place to stand, they come back to it repeatedly when disturbed and even after being hit by the net. The males are alert, fast flyers and difficult to get when in flight".

Scapanea frontalis (Burmeister), first identified from Puerto Rico by Mr. Rolla P. Currie ("IPSup" 1924–38), is primarily a mountainous species, Don Julio (1938–64) noting that "the nymphs in Puerto Rico, up to the present, have been collected only above the 500 feet level, becoming commoner higher up. The living adult males make themselves conspicuous while in flight by the white spot near the tip of the abdomen segments 7,

8 and 9, and which does not show in many preserved specimens. The females do not show this spot. Both are strong fliers, flitting close to the water, up and down the course of the stream, loitering over pools. They are extremely shy. They copulate without coming to rest. The nymphs prefer rapidly running water, clinging to the stones—some of them to the under surface". Described from Santo Domingo, this dragonfly is known only from the Greater Antilles.

Tramea abdominalis Rambur, identified by Herr Kolbe (1888–167) from material collected by Dr. Gundlach, is a common neotropical dragonfly of coastal Puerto Rico; abdomen red, with mid-dorsal black spot on 8–10, golden brown thorax, head and mouth-parts red or orange-yellow. Don Julio (1938–65) records seeing them "flocking together in large numbers while feeding on the Chironomids which keep in cluster from 12 to 15 or 20 feet above the ground". The nymphs seem scarce by comparison with the abundance of the adults, possibly due to the sinking of clusters of eggs to the bottom where they will be subject to the attacks of fishes and other enemies. Nymphs have been found only at Cartagena Lagoon.

Tramea binotata (Rambur), as determined by Dr. F. Ris, is noted by Mrs. Klotz (1932–70), adults having been collected at Manatí. Prof. Needham and Don Julio made collections at Tortuguero Lagoon, and at near-by localities as far as Arecibo, but the species is decidedly rare.

Tramea onusta (Hagen), as identified by Prof. James G. Needham, is noted by Don Julio (1938–66) as being much more abundant, and often flying with *Tramea abdominalis*, at numerous coastal localities from Las Cabezas and Ceiba to Cartagena Lagoon.

Pantala flavescens (Fabricius), listed by Dr. Gundlach, is not common in Puerto Rico. It "prefers sunny open spaces, where it flies tirelessly", according to Don Julio (1938–63), "keeping usually almost the same level, about five feet from the ground, while getting its food". Prof. Needham and he collected adults at Fajardo, Tortuguero Lagoon and at Yauco.

Idiataphe (= **Ephidatia**) **cubensis** (Hagen), as identified by Prof. James G. Needham, was collected by him only around Tortuguero Lagoon in Puerto Rico, adults being notably scarce when cast skins were numerous. The nymphs are subterranean, hiding among the roots of icaco (*Chrysobalanus icaco*) growing close to the margin, and of sedges and other rooted aquatic vegetation. The nymph was described by Prof. Needham and E. Fisher (Trans. Amer. Ent. Soc., **62**: 107–116, pl. 1. Philadelphia, 1936), not as unique morphologically as in its habits.

Coenagrionidae: Damselflies

Lestes forficula Rambur, first reported from Puerto Rico by Mrs. Klotz (1932–77) from collections along the north coast, at present appears to be the most abundant representative of the genus. Don Julio (1938–70) re-

cords the collection of nymphs at Las Cruces, at an elevation of 1,461 feet, and of cast skins at Cartagena Lagoon. At Tortuguero Lagoon, he noted the very abundant small white swamp moths, *Nymphula fluctuosa* Zeller, in attempting to escape from dragonflies by flying close to the water, were attacked by these and other damselflies occupying the same ecological niche.

Lestes spumarius Selys, identified and reported from Puerto Rico by Herr Kolbe (1888–172) from material collected by Dr. Gundlach, is much less abundant, and Prof. Needham and Don Julio failed to collect specimens. Mrs. Klotz (1932–78) notes a record by Selys, and a single specimen from Arecibo.

Lestes scalaris Gundlach, originally described from Cuba, was reported from Puerto Rico by Prof. P. P. Calvert (1909 and 1919), and collected by Prof. Needham and Don Julio at Florida (Yúnez River) and at Km. 6.7 on the Almirante Road.

Protoneura capillaris (Selys), reported by Baron Edmonde de Selys-Longchamps from Puerto Rico in 1886, has since been collected by Don Julio at Hato Rey: a single specimen, and in numbers at Carolina.

Telebasis dominicanum (Selys), identified as a *Erythragrion* by Herr Kolbe (1888–165) for Dr. Gundlach, and thus listed by them, is one of the common damselflies of the Island. It does not occur at the highest elevations, and Don Julio (1938–71) noted that the adults do not prefer the broad open spaces of the lagoons, but rather small streams bordered with weeds, or the margins of small bodies of water, altho Prof. Needham and he made collections from Guánica Lagoon: adults but no nymphs.

Telebasis vulnerata, described from type material from Puerto Rico, Cuba and Essequibo in Guiana by Hermann A. Hagen in his "Synopsis of the Neuroptera of North America" (*in* Smithsonian Institute Misc. Coll., **4**, 1862 pp. xx & 347. Washington, D. C., 1861), occurs at the higher elevations as well as at sea level, Don Julio noting adults in the Luquillo Mountains "in and above the La Mina Recreation Area, flying in the shade along the courses of small creeks". A nymph collected by Prof. J. G. Needham at Buena Vista Camp in the Maricao Forest, and reared by him to female adult, is described by Don Julio (1938-81) from the cast skin.

Leptobasis vacillans Selys, described from Cuba, is reported by Kolbe (1888–172) and Dr. Gundlach as collected by the latter in Puerto Rico.

Ceratura capreola (Hagen), was reported from Puerto Rico in Hagen's original description (1861–78). Adults keep among the plants and weeds, not flying in the open, according to Don Julio (1938–67), who records collections by Prof. Needham and himself at Tortuguero Lagoon, and in a swampy hollow close to the river at Florida.

Ischnura ramburii (Selys), a cosmopolitan damselfly known to occur from Canada to Paraguay, originally described from Cuba, is characterized by

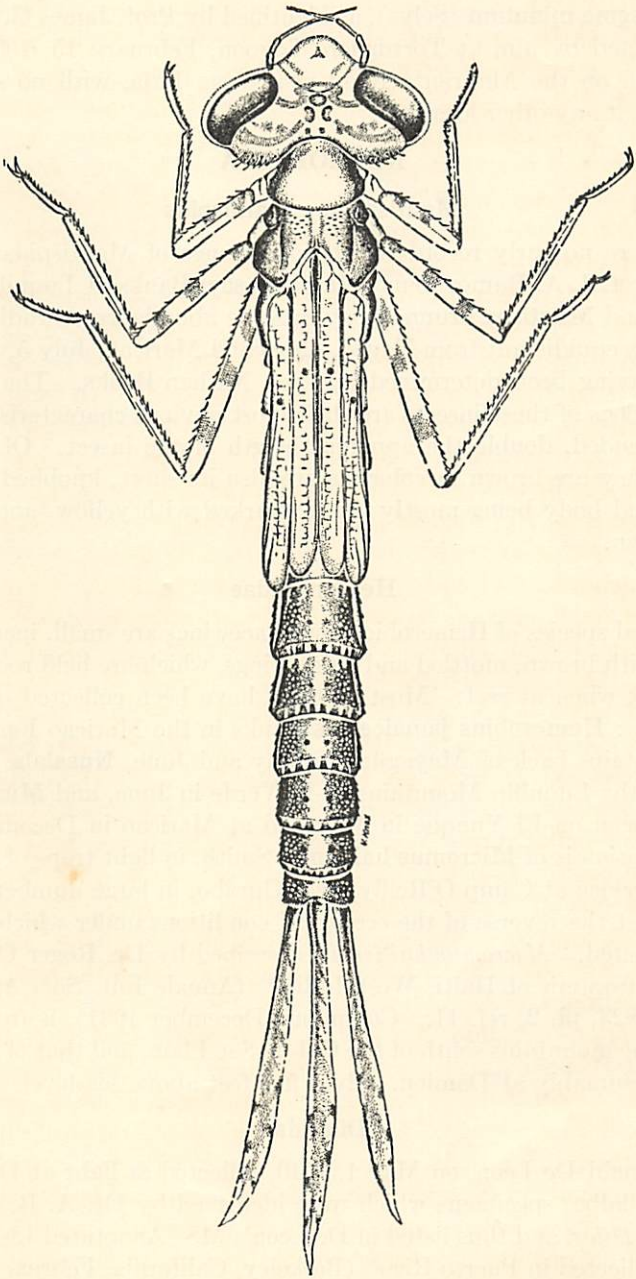
Don Julio (1938–69) as being "the most common damselfly on the Island through the entire year, but apparently restricted to the lower levels. There are no records above the 300 feet line. They become so numerous at times that, failing to find food enough for all, they resort to cannibalism. The pairs in copula fly for long periods together, resting among plants and flying about, but not necessarily ovipositing". Nymphs were found by him in the brackish Caño Tiburones, and with Prof. Needham in Tortuguero, Cartagena and Guánica Lagoons, and in the Río Piedras.

Enallagma civile (Hagen), a northern continental damselfly occurring also in all of the Greater Antilles, was first listed from Puerto Rico by Herr Kolbe (1888–170), identifying material collected by Dr. Gundlach (1894–267). Don Julio (1938–68) notes that "these dainty blue damselflies are found most often flying over pools and standing water. In flight they keep close to the surface of the pool and do not fly for long periods, pausing repeatedly on anything above the water and among the plants along the edge". He and Prof. Needham found adults at both Tortuguero and Cartagena Lagoons, at Río Piedras and at many other coastal localities, but nymphs are very scarce even when adults are most abundant.

Enallagma coecum (Hagen), the type of the typical variety being from St. Thomas and Cuba, was reported from Puerto Rico by Selys, Kolbe and Dr. Gundlach. Mrs. Klotz (1932–96) gives many records of collections from here. Don Julio (1938–68) notes that "nymphs have been collected above 1,000 feet level and the adults above the 2,000 feet line", preferring running to standing waters. In the creek at Florida, the nymphs outnumbered those of *Ischnura* ten to one, and were associated with no other damselfly nymphs.

Enallagma cultellatum (Hagen), as re-identified by Prof. James G. Needham from his original determination of *cardenium* Selys, as listed ("IB" 1936–60) for the first collection at Tortuguero Lagoon, February 10 and 15, 1935, proved to be much less abundant in August according to Don Julio (1938–69). Nymphs have also been found in the brackish water of Caño Tiburones.

Anomalagrion hastatum (Say), a northern continental damselfly, found in all of the Greater Antilles and first reported from Puerto Rico by Prof. P. P. Calvert (1909–210), is "the most inconspicuous of all the zygopterans on the Island", according to Don Julio (1938–66), "and easily overlooked because, although the male has a yellow color, this blends with the dry leaves of the plants in the near-by dry places back of the open waters where they occur. They keep among the plants and weeds, and the females, mostly dull colored, are not easily seen. It seems to be restricted to the lower levels", collections having been made at the Forest Service pool at Río Piedras, Tortuguero and Guánica Lagoons, and other coastal localities.



Nymph of the Damselfly, *Argiallagma minutum* (Selys), twelve times natural size. (Drawn by V. Knox.)

Argiallagma minutum (Selys), as identified by Prof. James G. Needham, was collected by him at Tortuguero Lagoon, February 15, 1935, and on March 9th on the Almirante Road near Vega Baja, with no subsequent collection at any other locality.

NEUROPTERA

Mantispidae: Mantispids

There are no early records of the occurrence of Mantispids in Puerto Rico. Prof. J. A. Ramos found **Mantispa sayi** Banks at Luquillo, August 5, 1932, and **Mantispa brunnea** Say in some abundance at Indiera, in the mountains equidistant from Yauco, Lares and Maricao, July 5, 1944, both species having been determined by Prof. Nathan Banks. The large raptorial forelegs of these insects are their most obvious characteristic, which, when extended, double the apparent length of the insect. Of the latter species, they are brown in color, as are also its short, knobbed antennae, its legs and body being mostly black, marked with yellow, and its wings clear brown.

Hemerobiidae

The local species of Hemerobid brown lacewings are small, inconspicuous insects, with brown, mottled and hairy wings, which are held roof-like over their back when at rest. Most of them have been collected only in the mountains: **Hemerobius jamaicensis** Banks in the Maricao Forest and in the mountains back of Mayagüez in May and June, **Nusalala damiensis** Smith in the Luquillo Mountains at El Verde in June, and **Micromus cubanus** Hagen on El Yunque in May and at Maricao in December. The only exception is of **Micromus haitiensis** Smith, in light traps of the Public Health Service at Camp O'Reilly, near Gurabo, in large numbers in June. This is just the reverse of the ecological conditions under which the types were collected. *Micromus haitiensis*, described by Dr. Roger C. Smith in "The Neuroptera of Haiti, West Indies" (Annals Ent. Soc. America, **24** (4): 798–823, pl. 2, ref. 11. Columbus, December 1931), is from Petionville, in the mountains south of the Cul-de-Sac Plain, and that of the *Nusalala* is presumably at Damien, only a few feet above sea-level.

Dilaridae

Dr. Donald De Leon, on May 1, 1940, collected at light at Doña Juana Camp, Villalba, specimens which were identified by Dr. A. B. Gurney as species of *Dilar*, and thus listed in De Leon's MS "Annotated List of Forest Insects collected in Puerto Rico" (Berkeley, California, February 7, 1941). Dr. Gurney now writes: "According to present conceptions, *Dilar* is restricted to the Old World. In the National Museum there is one specimen

of **Nallachius** from Puerto Rico, and Carpenter (Proc. Amer. Acad. Arts Sci., **74** (7): 273. 1940) reports an undescribed species of **Nallachius** in the M.C.Z. from Puerto Rico. It may be that the species of *Dilar* referred to is the same as this".

Chrysopidae: Aphislions

One of the largest of the aphislions or green lacewings, with two spots on the forewings and one on each of the hindwings is **Leucochrysa insularis** (Walker), identified by Kolbe as a *Protochrysopa* for Dr. Gundlach, and thus listed by him. Presumably it occurs in the mountains back of Mayagüez, but the only recent collections were made in November 1941, at El Verde Forest Service Camp in the Luquillo Mountains, where the insects were attracted to light in considerable numbers, and were collected in the morning from the ceiling, where they had remained overnight. Prof. Nathan Banks places the name *Nodita cerveraei* in synonymy.

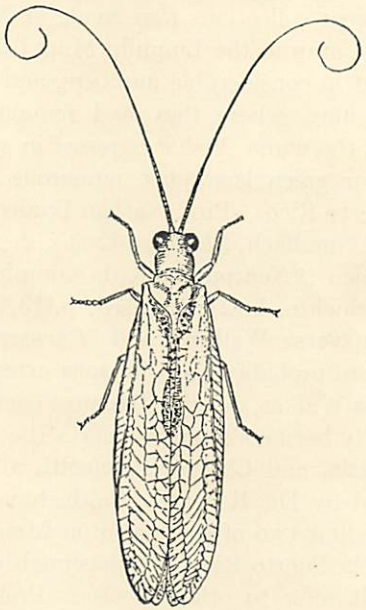
Of the aphislions or green lacewings, numerous species of the genus *Chrysopa* occur in Puerto Rico. Prof. Nathan Banks is of the opinion that of those listed by Dr. Gundlach, *Chrysopa krugii*, described by Herr. H. J. Kolbe from Puerto Rico ("Neuroptera v. d. Sammlung von Herr Krug", Archiv. fur Naturgeschichte, **1** (2): 153–178, p. 13, fig. 11. 1888) "may well be **Chrysopa transversa** Walker", and "*Chrysopa externa* Hagen is a U. S. species; the record probably was **Chrysopa exterior** Navas".

Chrysopa transversa Walker, possibly the most common species on Mona Island, has not recently been collected in Puerto Rico. **Chrysopa damiensis, Chrysopa haitiensis,** and **Chrysopa wolcotti,** all originally described from Haitian material by Dr. Roger C. Smith, have since been found in Puerto Rico, and the first two of these also on Mona. **Chrysopa collaris** Schneider does occur in Puerto Rico, but presumably some of the biologic records assigned to it refer to other species. Prof. Nathan Banks has identified specimens collected in Puerto Rico of **Chrysopa antillana** Navas, **Chrysopa cubana** Hagen, **Chrysopa cubensis** Navas, **Chrysopa estradai** Navas, and **Chrysopa exterior** Navas, making a total of eleven for Puerto Rico and four for Mona Island. Unfortunately, Smith's key to the Haitian species does not include some of these, making identification difficult if one does not have the older literature.

The female lacewing lays individual eggs at the end of tall silken stalks, rarely more than two or three at one time or place, and, to quote Essig, "always a source of wonder to those who discover them for the first time". The minute larva crawls down the stalk holding on by its prehensile tail, and starts off in search for live food. Young aphids are most acceptable and the larvae have been reared to adult by Mr. Thos. H. Jones, feeding them entirely on the yellow aphid of sugar-cane, *Sipha flava* Forbes. They

also eat mealybugs and the nymphs of Fulgorids, *Ormenis* spp. Most surprising of all is the attack of *Chrysopa* larvae on the eggs of the vaquita, *Diaprepes abbreviatus* L., which are laid between two leaves stuck together tightly with a glue so adhesive that the little vaquita grubs themselves have difficulty in escaping from its continuous strip around the egg-mass.

The accidental introduction into Puerto Rico of the cottony cushion scale, *Icerya purchasi* Maskell, for a time supplied an abundant and most acceptable supply of food for the Chrysopid larvae, until the native and introduced enemies of this scale almost exterminated it in Puerto Rico.



An adult *Chrysopa*. Three times natural size. (Drawn by F. Maximilien.)

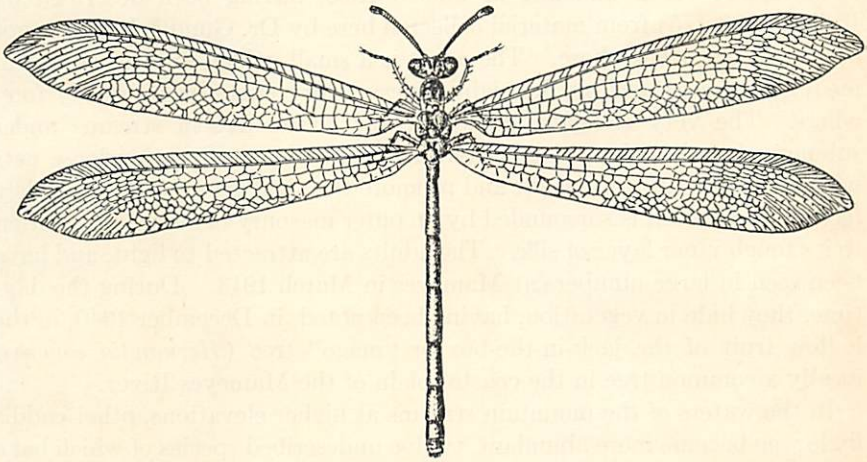
In the grove of beefwood or Australian pines (*Casuarina equisetifolia*) back of Camp Kofresí on Mona Island, however, the cottony cushion scale has managed to survive in much larger numbers, and on infested trees one often sees many of the round, white, parchment-like cocoons spun by the *Chrysopa* larvae which have been feeding on these soft scales.

The most obvious part of the *Chrysopa* larva is its tremendous and deadly jaws: hollow sickles thru which the body juices of its prey are sucked. Many species have the habit of attaching to their bodies, not the scalps of their victims, but its insect equivalent: anything in the way of empty skin or wax that is left after the luckless insect has been sucked dry. And anything still remaining of insect or other debris when the fully grown larva

starts to spin its cocoon may be entangled in its outer threads. Other larvae are completely naked, one noted at Indiera being brightly marked with chrome yellow on a black and brown body, and their cocoons are pearly white spheres, entirely devoid of camouflage. The adults are a symphony in green and gold, with extremely elongate antennae and the most iridescent of transparent wings.

Myrmeleonidae: Antlions

The antlions, with their short, clubbed antennae, and narrow grey wings, often an inch or more in length, are represented on Mona Island by the common **Psammoleon bistichus** (Hagen), dozens of which Dr. L. F. Martorell collected at light at Camp Kofresí in August. **Psammoleon minora**



Adult of *Myrmeleon insertus* Hagen. Twice natural size. (Drawn by F. Maximilien.)

Banks has been collected by Prof. J. A. Ramos both at Mayagüez and on Mona Island, and on Mona he also found **Myrmeleon insertus** Hagen. This latter is the common species in Puerto Rico, listed by Kolbe and Drs. Stahl and Gundlach, of which larvae are often noted in numbers in dry or sandy soil in all parts of the Island. Abundant as their inverted cones may be in soil under houses or under eaves, the adults rarely come to lights.

As an *Acanthaclisis*, Dr. Gundlach records the collection in Puerto Rico of **Vella fallax** (Rambur), and of its occurrence elsewhere, in México and South America. It has not since been found here.

Ascalaphidae: Ascalaphids

The Ascalaphids are possibly the largest of the Neuroptera, with long antennae, knobbed at the end. The **Ascalaphus hyalinus** Latreille, listed

by Dr. Gundlach, has not since been collected in Puerto Rico. The distinctively Puerto Rican species is **Ululodes opposita,** described by Prof. Nathan Banks as one of the "Antillean Ascalaphidae" (Jour. Agr., U. P. R., **22** (2): 177–180, pl. 1. San Juan, May 1938), first found at Cabo Rojo lighthouse, and later on Mona Island. Its male has a dark spot on the stigma of the forewing, the female a spot on the hindwing.

TRICHOPTERA: Caddis Flies

In Dr. Boyd B. Palmer's "A Contribution to the Life History of **Chimarrha albomaculata** Kolbe from Puerto Rico (Trichoptera: Philopotamatidae)" (Annals. Ent. Soc. America, **31** (1): 69–73, pl. 2, ref. 6. Columbus, March 1938), the most abundant caddis fly of the smaller coastal streams is discussed. It is endemic in Puerto Rico, having been described by Kolbe (1888-175) from material collected here by Dr. Gundlach, and is not known to occur elsewhere. The adult is a small golden-brown insect, immediately recognized by the eight silvery, hairy spots on its dusky forewings. The very elongate, golden yellow larvae live in streams under submerged rocks where dead leaves have caught, constructing loose nets which collect a fine film of silt and promote the algal growth on which they feed. The cocoon is surrounded by an outer masonry of stones in addition to its tough inner layer of silk. The adults are attracted to light, and have been seen in large numbers at Mameyes in March 1913. During the daytime, they hide in vegetation, having been noted, in December 1940, in the hollow fruit of the jack-in-the-box or "mago" tree (*Hernandia sonora*), locally a common tree in the coastal plain of the Mameyes River.

In the waters of the mountain streams at higher elevations, other caddis fly larvae become more abundant, twelve undescribed species of which have been identified and placed in genus and/or family by Dr. Cornelius Betten from the material collected by Drs. Needham and Julio García-Díaz in their ecological survey of fresh water insects. These include another **Chimarrha,** species of **Heliopsyche** (Sericostomatidae), and **Phylloicus** (Calamoceratidae), another **Setodes** (Leptoceridae) in addition to the **Setodes candida** Hagen collected by Dr. Gundlach and identified for him by Kolbe, a **Smicridea** (Hydropsychidae), a new genus in both the Polycentropidae and the Hydroptilidae, besides species of **Oxyethira, Neotrichia** and **Hydroptila** in the latter family, **Lype** in the Psychomyidae, and, at the end of the list (Appendix A., García-Díaz 1938–96), **Atopsyche** in the Rhyacophilidae.

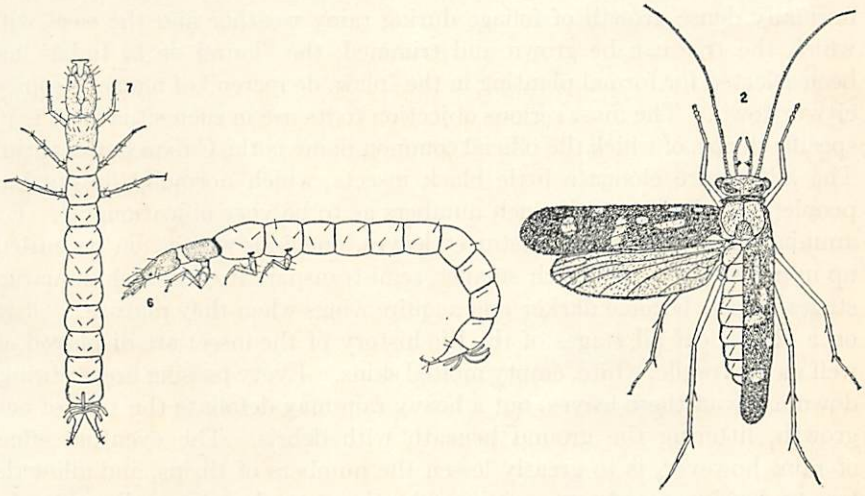
Apparently these collections represent only a fraction of the caddis fly population of the Island, for Dr. D. G. Denning of the University of Wyoming, has described five additional "New Trichoptera from Puerto Rico" (Annals Ent. Soc. America, **40** (4): 656–661, pl. 1. Columbus,

December 1947) from material collected at light trap by Dr. Harry D. Pratt, and identified two others not previously known from Puerto Rico.

Oecetis pratti, described by Dr. D. G. Denning (1947–656) from a single male from El Yunque, is 9.0 mm. long, and has a "long, slender, apically enlarged" tenth tergite.

Oecetis inconspicua (Walker), as identified by Dr. D. G. Denning, was collected in abundance in the vicinity of Laguna Tortuguero.

Chimarra luquillo was described by Dr. D. G. Denning (1947–657) from an abundance of material collected above Luquillo "from roaring streams coming out of the high tropical rain forest" of El Yunque at an approxi-



The common Caddis Fly, *Chimarrha albomaculata* Kolbe: larva from above (7) and from the side (6), about three times natural size, and male adult (2), about five times natural size. (Drawn by Boyd B. Palmer.)

mate elevation of 500 feet. "In both sexes the head, body antennae and legs (are) bright yellow, setae of head and thorax yellow, spurs brownish; the fore wings blackish with a number of bright silver markings".

Chimarra aterrima Hagen was identified by Dr. Denning from a pair collected at Luquillo by Dr. H. D. Pratt in November 1943.

Cheumatopsyche protera was described by Dr. D. G. Denning (1947–658) from a pair collected at light trap at Luquillo, 6.0 mm. long, "wings brownish with a distinct white spot along margin of forewing".

Polycentropus zaneta was described by Dr. D. G. Denning (1947–660) from two pair collected at Luquillo, making no mention of their size or general appearance.

Rhyacophila carula was described by Dr. D. G. Denning (1947–660) from material taken from light trap at Luquillo, both male and female being 9.0 mm. long.

THYSANOPTERA: Thrips

The curled-up, distorted tender young leaves of the "laurel de la India" (*Ficus nitida*), which occur in ever increasing numbers as periods of drought lengthen, are a most obvious symptom of the presence of one kind of thrips, **Gynaikothrips ficorum** Marchal (= *G. uzei* Zimmerman, = *Liothrips bakeri* Crawford), on this one kind of tree. During an exceptionally dry spring, the new growth will be attacked so severely that all of these atrophied leaves drop off, and only old leaves remain on the tree. Because of its normally dense growth of foliage during rainy weather and the ease with which the tree can be grown and trimmed, the "laurel de la India" has been selected for formal planting in the "plaza de recreo" of many a tropical city or town. The most serious objection to its use in such situations is its specific thrips, of which the official common name is the Cuban laurel thrips. The adults are elongate little black insects, which normally do not bite people, but often occur in such numbers as to be very objectionable. Examining one of the freshly distorted leaves, one finds within, on its curled-up upper surface, the much smaller, semi-transparent, yellowish immature stages, which become darker and acquire wings when they mature. Often on a single leaf all stages of the life-history of the insect are displayed, as well as the fragile, white, empty molted skins. Every passing breeze brings down a few of these leaves, but a heavy rain may defoliate the tree of new growth, littering the ground beneath with debris. The eventual effect of rain, however, is to greatly lessen the numbers of thrips, and allow the tree to develop new leaves uninjured by their attack. Normally, the rainfall on El Yunque is ample, but during a dry spring this thrips may become injuriously abundant even there, just as it is practically every year in the plazas of Guayama, Caguas and Manatí, and on the campus of the University of Puerto Rico. The trees recover promptly with the advent of rainy weather, but artificial control is possible at any time. Spraying with one-quarter of one percent of Aldrin (Hyman 118) as a water emulsion will kill all thrips in overnight, but does not prevent eventual re-infestation if unsprayed trees are nearby.

Forty species of thrips are reported as occurring in Puerto Rico, of which twelve have been described from material collected here, and presumably many more occur here, merely awaiting an industrious collector. It need not necessarily be a human collector, for three new endemic species were first found in the stomachs of lizards, when "The Food of Porto Rican Lizards (Jour. Dept. Agr. P. R., 7 (4): 5–37, ref. 8. San Jaun, August 1924) was being studied and these small insects were found entire and un-

harmed, wrapped in a mucilaginous coating in the anterior part of the digestive canal. Mr. A. C. Morgan ("A New Genus, a New Subgenus and Seven New Species of Thysanoptera from Porto Rico", Florida Entomologist, **9** (1): 1–9. Gainesville, 1925) described **Gastrothrips anolis** and **Gastrothrips fuscicauda** from specimens found in the stomachs of *Anolis cristatellus* at Río Piedras, October 3, 1923, and **Lissothrips (Prolissothrips) stratulus** from material taken from *Anolis stratulus* collected by Mr. F. Seín on May 9, 1924 on the lower slopes of El Yunque above Hda. Santa Catalina. The large black adult and the many nymphs with bright red thorax and abdomen, their legs, prothoracic plate and terminal segment black, found in rotten cotton boll injured by pink bollworm at Pt. Cangrejos, and others on the leaves of *Inga vera* at Cayey, Mr. Morgan (1925–7) described under the name **Diceratothrips wolcotti.** Others on leaves of *Inga vera* at Cayey he identified as **Ommatothrips gossypii** Hood.

Identified as a new species of **Cryptothrips** by Prof. J. R. Watson were thrips found on the leaves of seagrape (*Coccoloba uwifera*) at Quebradillas in January 1945, of which the immature forms were bright yellow, and the winged female adults were a very intense yellow except for the black head and the tip of the abdomen. The nymphs remained quietly on the upper surface of the leaves in the hollows between the galls of *Ctenodactylomyia watsoni* Felt, but the adults crawled actively about, often entering the empty gall when an emergence hole made this possible.

The inter-relations of thrips to various other small insects and other thrips are often complicated, for some species are predaceous. In his "Notes on Puerto Rican Thysanoptera" (Jour. Dept. Agr. P. R., **10** (3 & 4): 279–281. Río Piedras, September 1927), Dr. H. L. Dozier records the collection of **Aleurodothrips fascipennis** Franklin "from citrus material infested with soft and purple scale, May 24, 1925, at Río Piedras" without attempting to determine its status. But of **Hoplandothrips reynei** Priesner, he implies that it is predaceous on the pustule scale, claiming to have reared it from *Asterolecanium pustulans* on "cañafístula" (*Cassia fistula*). (According to Mr. J. C. Crawford, it "undoubtedly feeds on decaying vegetation, likely on fungi or the sap therefrom.") **Liophloeothrips portoricensis** Watson MS was associated with citrus mealy-bug and scale on grass at Río Piedras. **Franklinothrips vespiformis** Crawford, definitely known to be predaceous, was found by Dr. Dozier on whitefly-infested foliage of guava (*Psidium guajava*) and by Mr. E. G. Smyth on the leaves of beans and sweet potato infested with various small insects. In lima bean flowers infested with thrips at Isabela, a single specimen identified by Prof. J. R. Watson was noted, and Dr. Dozier reports it in rose flowers.

That **Haplothrips merrilli** Watson, as doubtfully identified by Dr. J. D. Hood, was associated by Dr. Dozier (1927–28) "with either scale or whitefly

material would indicate that the species is most likely predaceous on the young."

Haplothrips gowdeyi Hood, first reported by Dr. J. D. Hood "On a Collection of Thysanoptera from Porto Rico" (Insecutor Inscitiae Menstruus, 1 (12): 149–154. Washington, D. C., December 1913), has subsequently been found on such botanically diverse hosts as "almendra" (*Terminalia catappa*), the weed *Blechum brownei*, and the flowers of "margarita", *Bidens pilosa*. It is sometimes so abundant on the flowers of tuberose as to be of economic importance, and so persistent in remaining on this host and on carnations as to be still present on the withering flowers and intercepted by the Plant Quarantine Inspector at Philadelphia.

Haplothrips tibialis, described by Dr. J. D. Hood as one of "Two Porto Rican Thysanoptera from Sugar Cane", (Insecutor Inscitiae Menstruus, 2 (3): 38–41. Washington, D. C., March 1914) was collected by Mr. Thos. H. Jones at Río Piedras. The adults are black in color, and the species has been subsequently called the black thrips of sugar-cane, despite its scarcity and apparent lack of economic importance. The other, listed first as a *Haplothrips*, and subsequently as a *Heliothrips*, is **Hercinothrips femoralis** (Reuter), altho found only in the central whorl of young ratoon cane in Puerto Rico, is a cosmopolitan species with a wide range of hosts.

When an intensive search was being made for possible vectors of the mosaic disease of sugar-cane, numerous collections of the not very abundant thrips to be found in the central whorls were made. From this material, Mr. A. C. Morgan (1925–4) described as new **Anaphothrips bicolor,** collected from the leaves of sugar-cane at Bayamón, May 25, 1920.

"**Anaphothrips** (**Chaetanaphothrips**) **orchidii** (Moulton), with brown wings, and **Scirtothrips longipennis** Bagnall, a small brown species with forewings black to the tips, have caused more injury to *Chinchona* than any other insects thus far encountered," according to Messrs Harold K. Plank and H. F. Winters reporting on the "Insect and other Animal Pests of Chinchona and their Control in Puerto Rico" (Bulletin No. 46, Federal Experiment Station, Mayagüez, pp. 16, fig. 5, ref. 16. Washington, D. C., February 1949). "Both have occurred in the greenhouse at Mayagüez (elevation 50 feet), as well as in the nurseries at Maricao and Toro Negro," high in the mountains, attacking only small to medium-sized plants. For control, "weekly applications of the one per cent rotenone dust gave the best results and proved to be the most practicable for small plants under all conditions." Two other black species of thrips, **Tryphactothrips angulatus** (Hood) and *Dinurothrips hookeri* Hood were also found on *Chinchona ledgeriana* trees at Toro Negro, as well as the common greenhouse thrips *Heliothrips haemorrhoidalis* (Bouché), first noted on *Chinchona calisaya* Wedd.

Karynothrips melaleneus (Bagnall), listed by Mr. Morgan as *Hindsiana cocois* Watson, was collected on sugar-cane at Camuy, April 26, 1920.

Karynothrips flavipes (Jones), listed as *Hindsiana weigeli* by Mr. Morgan, was collected from sugar-cane at Río Piedras, Feb. 23, 1920.

Limnothrips cerealium Haliday was identified by Mr. Morgan from material collected on the leaves of sugar-cane at Guánica, March 18, 1920.

When Dr. F. M. Wadley reported his "Observations on some Insects associated with Sugarcane in Puerto Rico" (Jour. Agr. U. P. R., 21 (2): 103–114, ref. 15. Río Piedras, July 1937), he listed no thrips from sugar-cane, but "**Chirothrips mexicanus** Crawford was repeatedly noted in heads of *Eleusine indica*", a common grass in cane fields called "yerba dulce".

Podothrips semiflavus was one of "Two New Thysanoptera from Porto Rico" (Insecutor Inscitiae Menstruus, 1 (6): 65–70, pl. 1. Washington, D. C., June 1913) described by Dr. J. D. Hood from material collected at Guánica from "malojillo" (*Panicum barbinode*), growing in cane fields.

This by no means concludes the list of thrips found on or associated with sugar-cane in Puerto Rico. Possibly the most abundant, and certainly the most frequently collected thrips in the central whorl of leaves of cane during times of drought is **Frankliniella williamsi** Hood, of which the adults are yellow. Subsequently called the "yellow thrips of sugar-cane", it was first identified by Mr. A. C. Morgan, and is the only species of this genus not associated with flowers. It can hardly be considered an economic species, for no appreciable damage due to even the heaviest infestations has been noted.

During dry weather, many kinds of thrips are found in flowers. The most common is possibly **Frankliniella insularis** Franklin, which is often a serious pest of roses, dahlias and gardenias, the flowers having so many of these black insects hiding between their petals that young ladies are repelled at the thought of wearing them. Cut flowers are not the only hosts, for this thrips occurs on many other kinds of flowers: those of such crops as beans, lima beans, broccoli, pigeon peas, and of trees, such as grapefruit, citron, "roble" (*Tabebuia pallida*), "cereza" (*Malpighia punicifolia*) and cannon-ball tree (*Couroupita guianensis*). It was first mentioned by Dr. J. D. Hood, reporting "On a Collection of Thysanoptera from Puerto Rico" (Insecutor Inscitiae Menstruus, 1 (12): 149–154. Washington, D. C., December 1913), listed by Van Zwaluwenburg, and found by Dr. Wetmore to have been eaten by the green mango (*Anthracothorax viridis*), which is a bird, not a fruit. Dr. M. D. Leonard reports its occurrence on Vieques Island, on roses and cannas, and on hibiscus flowers at Mayagüez. It also occurs on such plebeian flowers as crotalaria and the little wild daisy or "margarita" (*Bidens pilosa*). Prof. James G. Needham in

Florida, observing that "An Insect Community Lives in Flower Heads" (Nat. Geographic Mag., **90** (3): 340–356, with photographs by Willard R. Culver, 11 in color. Washington, D. C., September 1946) of *Bidens pilosa*, which he calls shepherd's needles, notes that it is "a honey plant of some importance. The flowers are very pretty and give off a delicate fragrance. Honey made from their nectar has something of the same fragrance. This Bidens (meaning 'two-pronged': seeds with two long barbed prongs) is a common roadside and pathside weed in the coastal areas of southern Florida and throughout the West Indies. It is a tender plant that is killed by even a light frost. It is long-lived and vigorous, but it dies back from the top after fruiting, and comes again from below in new branches that appear in all-season succession. Thus it is in flower and in fruit every day in the year . . . thrips . . . are the most constant residents in all Bidens flower heads. They are small enough to enter bodily into the crevices between flowers, or go down into the depths of the corolla tubes and live there, adults and young together. Individually they are so small that the damage to the plant is usually negligible." Prof. Needham gives no names of specific thrips, but in Puerto Rico, in addition to the common flower thrips, *Frankliniella insularis*, two others of the same genus: **Frankliniella melanommata** Williams, the flower thrips of the West Indies, and **F. cubensis** Hood have been found in considerable abundance in the flower heads of this daisy, as well as **Thrips abdominalis** Crawford and **Haplothrips gowdeyi** Hood.

Frankliniella cubensis Hood is possibly only an incidental resident on *Bidens pilosa* flower heads, and in the flowers of hibiscus, crotalaria and citrus, for it has been found in great abundance on the leaves of yuca (*Manihot utilissima*) in June 1933 by Mr. F. Seín, causing a puckering, crinkling and yellowing of the leaves simulating a mosaic disease. Prof. J. R. Watson, who identified the material, notes that a very similar Florida species, "although mostly an inhabitant of blossoms, will sometimes attack other tender vegetation. It causes quite a crinkling of the foliage of peanuts, sometimes, and occasionally of beans and cucumbers".

Corynothrips stenopterus Williams, as determined by Mr. A. C. Morgan, was observed by Mr. E. G. Smyth in 1919 to be causing injury to yuca at Río Piedras.

The record of **Frankliniella tritici** Fitch in Puerto Rico, questioned by Prof. J. R. Watson (1923–39) as being "probably *cephalica*" is confirmed by a subsequent identification by Dr. J. D. Hood of material collected by Dr. H. L. Dozier (1927–280) in flowers of grapefruit at Trujillo Alto. It is by no means the most abundant thrips normally found in the flowers of grapefruit, Dr. M. D. Leonard in his note on "Thrips Injury to Citrus and Rose in Puerto Rico" (Jour. Ec. Ent., **25** (4): 934–5. Geneva, August 1932)

making no mention of it, but only of the black *F. insularis* and the yellow *F. cubensis*, and the collection by Mr. A. S. Mills at Palo Seco and Vega Alta of **F. difficilis** Hood, as determined by Prof. J. R. Watson, from grapefruit blossoms. Subsequently, this species was found on dahlia flowers at Sabana Llana by Mr. Miguel Angel Díaz, and on hibiscus flowers at Ponce by Mr. R. G. Oakley. **Frankliniella citripes** Hood, as identified by Prof. J. P. Watson, has been collected on the flowers of citron (*Citrus medica*) at Las Marías.

The type of **Frankliniella borinquen,** described on p. 675 by Dr. J. D. Hood in his "A Century of New American Thysanoptera III" (Revista Ent., **12** (3): 547–678. Rio de Janeiro, 1942), is from Puerto Rico, collected by Prof. James G. Needham on flowers of *Bidens pilosa*. The type of **Dinurothrips hookeri** Hood (1913–149) was collected by Dr. C. W. Hooker on sweet potato at Mayagüez, and Mr. E. G. Smyth found thrips on this host at Río Piedras which he considered to be this species.

Taeniothrips simplex Morison, the introduced gladiolus thrips, appeared in Puerto Rico soon after gladioli began to be grown here on a large scale, and now appears promptly whenever this host is planted. Injury is negligible during most of the year, but in the spring, and during extended periods of drought may become severe. As there is no dormant season for corms, the treatments used in control of this thrips on corms during the winter can not be used in Puerto Rico. Plants must be watched closely for the first signs of the feeding of the thrips, and spraying started immediately and continued at weekly intervals until flowering. The recommended spray combination, given on Picture Sheet No. 6, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C., April 1941, is as follows:

	Small quantities	Large quantities
Tartar emetic	1 ounce	2 pounds
Brown sugar	2 ounces	4 pounds
Water	3 gallons	100 gallons

Economically, the most important thrips is the cosmopolitan **Thrips tabaci** Lindemann as a pest of onions, which promptly appears on this crop wherever grown. On Mona Island, the initial planting of onions in 1940 was attacked, and all later ones completely destroyed. Planted early enough in the fall so that they approach maturity before the dry weather of late winter and early spring, onions grow well and produce a bountiful crop in Puerto Rico. Planted so late that drought hits them before they are more than well started, infestation by thrips can absolutely ruin the harvest. All thrips are very sensitive to relative humidity, becoming abundant in dry weather, and practically disappearing in wet weather.

This is the key to the successful growing of onions everywhere, but especially in Puerto Rico where the seasonal occurrence of dry weather can be predicted with some accuracy.

The immature stages of the onion thrips are minute and semi-transparent, yellowish, so small and so well hidden under the parchment scales and between the bases of the leaves as to be rather difficult to see. But no one can fail to recognize the wilting and withering of the leaves which is the result of their feeding, becoming more serious as dry weather continues and the thrips become more abundant. If the attack begins when the onions are only half grown, they never can mature, for control depends upon taking advantage of the normally heavy rainfall in the autumn in Puerto Rico, or, failing this, in spraying before injury becomes at all noticeable. The grower who starts spraying only after the withering becomes serious is only wasting his time and energy. In countries where onions are grown under irrigation, and heavy infestations by thrips may be anticipated no matter at what season they are planted, spraying with nicotine sulfate and soap or fish oil is started just as soon as the tender onion leaves appear above ground, and continued without stopping until the onions have almost reached full size. In this way, and only in this way, has it been possible to grow onions successfully where there is little or no rainfall. This is in contrast to the favorable conditions normally present in Puerto Rico, where the growing season may be made to coincide with heavy autumnal rains, and harvesting with the dry weather of winter. At the present time, the nicotine sulfate spray is quite outdated by the tartar emetic and brown sugar spray which was developed for use against the thrips of gladioli, and was soon found to be equally effective against the onion thrips. The most recent development in thrips control is by means of spraying or dusting with DDT, which is equally effective, but not noticeably more effective than tartar emetic, and benzene hexachloride as a dust with 1% gamma isomer content.

The type of **Heterothrips sericatus** Hood (1913–66) was from a great abundance of material found by Mr. Thos. H. Jones in the blossoms of guava (*Psidium guajava*) at Río Piedras, in June 1912. Twenty years and three days later, Mr. A. S. Mills found it very abundant in the blossoms of one bush at Barceloneta. Most recently it was noted on the same host at Palo Seco.

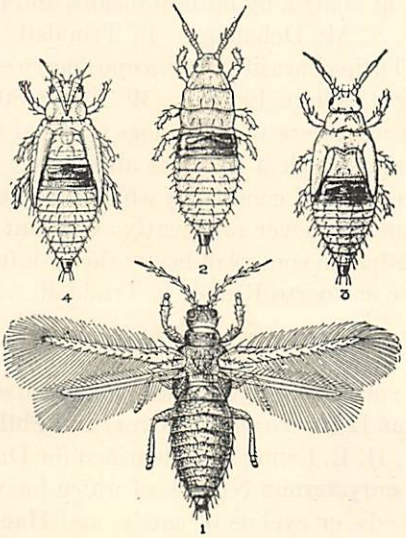
The type of **Heterothrips borinquen,** described by Mr. J. D. Hood (Insecutor Inscitiae Menstruus, 3 (1–4) : 1. Washington, D. C., January–April 1915) was from material collected by Mr. Thos. H. Jones in blossoms of an undetermined plant (Johnston № 2187) between Laguna San José and Martín Peña.

The host of **Cercyothrips striatus** Morgan (1925–1) is similarly uncertain, Mr. E. G. Smyth noting it as a climbing vine at Río Piedras, while **Serico-**

thrips portoricensis Morgan (1925–3) is unaccessioned material collected by him at Río Piedras, March 20, 1920.

In November 1923 the leaves of alfalfa at Río Piedras grown with seed imported from México were noted by Mr. F. Seín as infested with thrips, identified by Mr. A. C. Morgan as *Heliothrips fasciatus* Pergande. This is the common continental bean thrips, now known as **Hercothrips fasciatus** (Pergande), not since found in Puerto Rico, and presumably not established here.

Heliothrips haemorrhoidalis (Bouché), another continental species commonly known as the greenhouse thrips, was collected by Dr. C. W. Hooker at Mayagüez and listed by Dr. Hood (1913–149). Dr. H. L. Dozier



The Red-Banded Thrips, *Selenothrips rubrocinctus* (Giard): adult, larva, pre-pupa and pupa, greatly enlarged. (After Russell.)

(1927–280) found it "abundant, breeding on leaves of an introduced plant, *Barringtonia speciosa*, at Río Piedras, May 24, 1925." It has been identified from grapefruit at Palo Seco, and Mr. E. G. Smyth thought it this species which he observed on orange leaves at La Muda.

Selenothrips rubrocinctus (Giard), the cacao thrips of Trinidad, elsewhere known as the red-banded thrips, is of comparatively little economic importance in Puerto Rico. It is often so common during dry winter weather that its mass feeding causes the leaves of the "almendra" (*Terminalia catappa*) to change their normal green color for a silvery appearance. The adult thrips is black in color, but the larva, pre-pupa and pupa are transparent yellowish except for a broad band of red around the middle of their

bodies, whence the specific name of *rubrocinctus*. The rapidly growing larvae have balanced at their hind end, held high in the air, a sphere of dark brown excrement which is, from time to time, deposited on the leaf. Such dark spots of dried thrips excrement alternate with the silvery areas rasped dry by the feeding of larvae and adults. The leaves of many other common trees, such as mango, jobo, pajuíl, guava, achiote, cenizo and cucubano are more rarely heavily infested, and Dr. Dozier (1927–279) notes injury to those of grapes and cultivated berries. Cacao is so rarely grown in Puerto Rico that it has not even been noted as a host for this thrips, but in Trinidad cacao groves it is a major pest.

A minute wasp parasite, *Dasyscapus parviventris* Gahan, discovered both in Java and on the Gold Coast of Africa, was successfully introduced into Trinidad in an effort at control by natural means, and later was brought to Puerto Rico by Mr. S. M. Dohanian. In Trinidad, he had studied the "Life-History of the Thrips Parasite, *Dasyscapus parviventris* Gahan, and the Technic for Breeding it" (Jour. Ec. Ent., **30** (1): 78–80, ref. 6. Menasha, February 1937), but was there for too short a period to discover the ecological conditions under which it becomes abundant. Unfortunately, the parasite thrives under humid conditions which are least favorable for the thrips, and is consequently never sufficiently abundant during dry weather to exert appreciable effect in control of heavy thrips infestations on cacao or any other host, either in Puerto Rico or in Trinidad.

ANOPLURA: True Lice

The cosmopolitan species of the true lice (Pediculidae) on man: **Pediculus humanus humanus** L. (= *capitas* DeGeer) and **Phthirius pubis** L. occur in Puerto Rico. Dr. H. E. Ewing also identified for Dr. H. L. Van Volkenberg **Haematopinus eurysternus** Nitzsch of which heavy infestations have been noted on the body or eyelids of cattle, and **Haematopinus tuberculatus** Burmeister which is very common in the swtich of the tail of cattle on the south coast. **Haematopinus adventicus** Neumann sometimes becomes abundant on closely confined pigs. **Linognathus africanus** Kellogg & Paine has been found on goats, and Dr. W. A. Hoffman collected **Linognathus piliferus** Burmeister on a dog. From rhesus monkeys in captivity in the cages at the School of Tropical Medicine, Dr. Hoffman collected **Pneumonyssus griffithi** Newstead.

HOMOPTERA

Cicadidae: Cicadas

In "The Cicadas of Porto Rico with a Description of a New Genus and a New Species" (Jour. N. Y. Ent. Soc., 36 (1): 29–34, fig. 2, pl. 1. New York, March 1928), Mr. Wm. T. Davis describes **Borencona aguadilla,** from a type at Indiera, in the mountains north of Yauco, others from Lares, Aibonito and Mayagüez, as being of a "brownish color, pepper and salt appearance—sides of pronotum expanded—medially angulated into sharp points." When alive, this cicada is more greenish-grey in color, admirably matching its coffee grove or tropical forest environment of greenish-grey lichens on the trunks of trees. Altho individuals have been found as far east as Rio Piedras, normally it is an inhabitant of the coffee groves and the higher forests of the western end of the Island. Dr. Wetmore found it eaten by the kingbird and the flycatcher, and presumably the nymphs found around the roots of coffee trees at Añasco were of this species.

Proarna hilaris Germar is the common cicada of Puerto Rico, occurring in all parts of the Island, including the most xerophytic. Dr. Wetmore found it an important factor in the food of birds, for presumably it is more readily caught by them than by terestrial entomologists. It has not been found eaten by toads, and apparently is too large to be eaten by lizards. This cicada constituted 4.16% of the food of the ground cuckoo, and 2.47% that of the petchary. It was eaten in smaller numbers by the mangrove cuckoo, the woodpecker, the owl, flycatcher, kingbird, blackbird, oriole, mozambique, the yellow warbler and several vireos. Nymphs have been found in sandy soil being plowed at Mameyes, and at Palo Seco, apparently feeding on the roots of *Wedelia trilobata*, this being practically the only plant present where the nymphs occurred. Altho primarily a coastal species, it also occurs in the mountains, having been collected at Utuado, Coamo and Trujillo Alto.

Cercopidae: Froghoppers

All the froghoppers occurring in Puerto Rico are small, inconspicuous brownish species, much less noticeable than the masses of bubbles, supposedly resembling "frog-spit", which surround the nymphs. The species of **Epicranion**, most often referred to as *championi* Fowler, is usually seen as nymphs inside masses of bubbles around coffee berry clusters, but it is not restricted to a single host for it has also been taken on the twigs of *Inga vera*, and a heavy infestation on twigs of *Ficus stahlii* between Camuy and

the Guajataca Dam in October 1940 included numerous adults. Mr. Francisco Seín, attempting to rear adults, found that most of the whitish nymphs which he collected from coffee at Lares turned black within a few days, being parasitized by an Encyrtid wasp parasite, *Carabunia myersi* Waterson. The maggots of a fly also pester the nymphs inside their liquid covering, and it is hardly surprising that adults are so rarely noted.

The adults of **Philaenus fusco-varius** Stål are minutely pilose, the forewings being marked with two lighter spots and a crescent. They have been noted most often on guava (*Psidium guajava*) but are not confined to a single host, for collections have been made on pomarrosa, mulberry and on both coffee shade trees, and Dr. Stuart T. Danforth had specimens from the Cartagena Lagoon. The nymphs have not been observed.

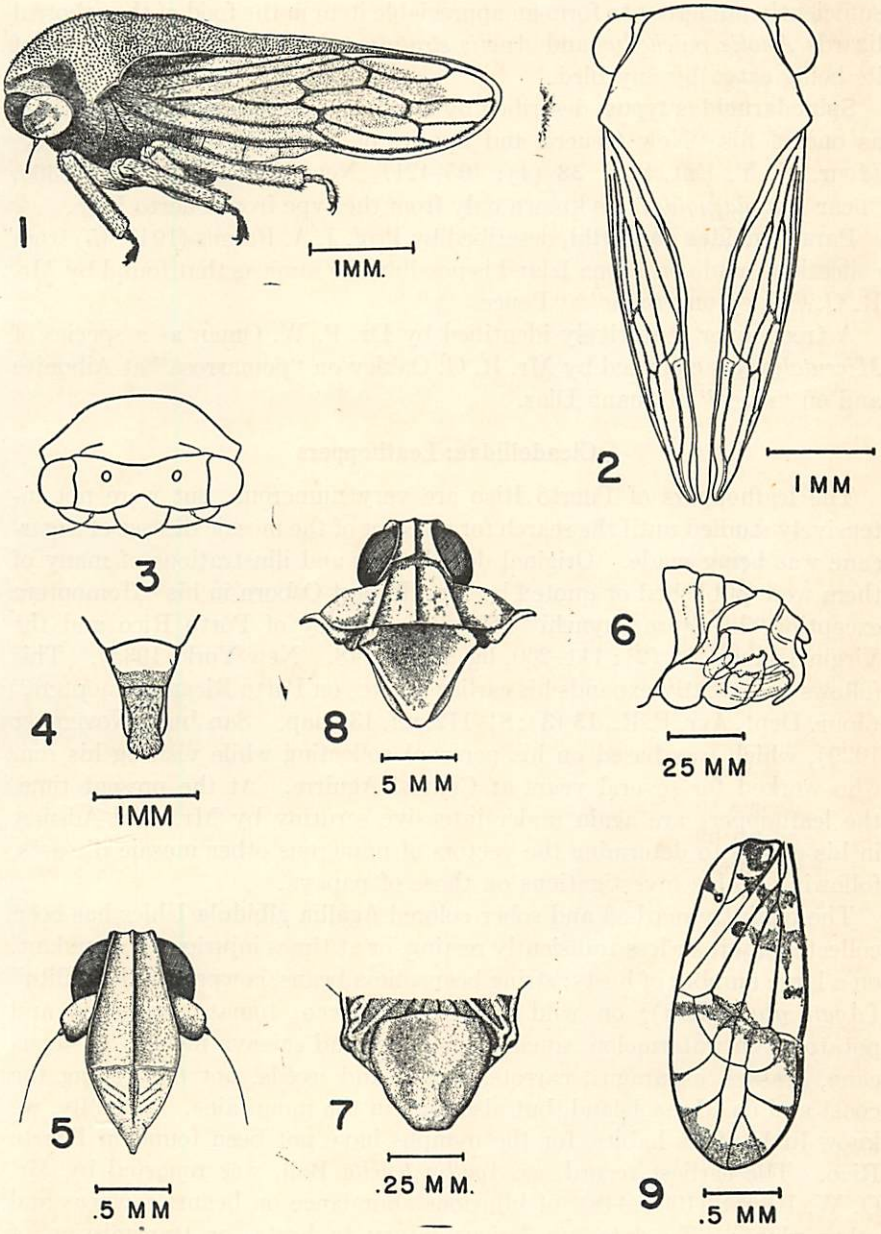
The **Clastoptera brevis** Walker "credited to Porto Rico by Lallemand" according to Dr. Herbert Osborn (1935–128), is "neither *brevis* nor *singifera*" as viewed by Dr. P. W. Oman. It has been intercepted on El Yunque, at Cidra, on coffee at Mayagüez and on mangrove at Ponce.

Membracidae: Treehoppers

Nessorhinus gibberulus Stål, "the most abundant and common species of membracid in Puerto Rico" according to Dr. H. L. Dozier ("New and Interesting West Indian Homoptera", American Museum Novitates No. 510, pp. 24, fig. 18. New York, December 15, 1931), is grey or brown in color, with a smoothly curving pronotum expanding into a snout-like process in front and a much more elongate spotted process behind. The earlier records as *Antianthe expansa* Germar, as identified by Prof. W. D. Funkhouser, refer to this species as found on cotton and coffee, but it shows no clearly defined host preference, having been collected on many and diverse plants and trees from the coast to the most elevated coffee groves.

Nessorhinus vulpes Amyot & Serville has the frontal process of its pronotum curved up, as is shown in the drawing by L. Pierre-Noël, and **Nessorhinus graciloides,** described by Dr. Dozier (1931–3) from a single male from Caguas, a shorter, straight process. Both have an elevated central crest, and neither is abundant, altho Dr. Osborn had specimens of the former from Lares and Mayagüez, and it has been intercepted on pigeon pea at Mayagüez and on icaco at Arecibo.

The broadly rounded and intensely black, shining pronotum produced into a slender spine behind, identifies **Monobelus fasciatus** (F.), a comparatively common species, found in all parts of the Island on a great variety of hosts, showing no apparent preference for any one plant. It is



The Membracid, *Paradarnoides danforthi* Ramos, from Mona Island: 1. Lateral view, 2. Dorsal outline, 3. Frontal view of head, 4. Male genitalia. The Fulgorid (Kinnaridae) *Paraprosotropis monensis* Ramos from Mona Island: 5. Frontal view of head, 6. Lateral view of male genitalia, 7. Ventral view of female subgenital plate, 8. Dorsal view of head and thorax, 9. Tegmen. (Drawn by J. A. Ramos.)

sufficiently numerous to form an appreciable item in the food of the arboreal lizards *Anolis pulchellus* and *Anolis stratulus*, altho there are no records of its being eaten by any bird.

Spinodarnoides typus, described by Dr. W. D. Funkhouser (pp. 413–14) as one of his "New Genera and Species of Neotropical Membracidae", (Jour. N. Y. Ent. Soc., **38** (4): 405–421. New York, December 1930), "near *Paradarnoides*", is known only from the type from Puerto Rico.

Paradarnoides danforthi, described by Prof. J. A. Ramos (1947–15) from collections made on Mona Island is possibly the same as that found by Mr. R. G. Oakley on "roble" at Ponce.

A treehopper tentatively identified by Dr. P. W. Oman as a species of *Micrutalis* was collected by Mr. R. G. Oakley on "pomarrosa" at Aibonito and on "moca" at Juana Díaz.

Cicadellidae: Leafhoppers

The leafhoppers of Puerto Rico are very numerous, but were not intensively studied until the search for a vector of the mosaic disease of sugar-cane was being made. Original descriptions and illustrations of many of them were published or quoted by Dr. Herbert Osborn in his "Homoptera excepting the Sternorhynchi" (Scientific Survey of Porto Rico and the Virgin Islands, **14** (2): 111–260, fig. 71, ref. 48. New York, 1935). This follows and greatly expands his earlier "Notes on Porto Rican Homoptera" (Jour. Dept. Agr. P. R., **13** (3): 81–112, ref. 13, map. San Juan, November 1929), which was based on his personal collecting while visiting his son, who worked for several years at Central Aguirre. At the present time, the leafhoppers are again under intensive scrutiny by Mr. José Adsuar, in his efforts to determine the vectors of numerous other mosaic diseases, following up his investigations on those of papaya.

The quaintly marked and sober colored **Agallia albidula** Uhler has been collected, more or less transiently resting, or at times injuriously abundant, on a large number of hosts: string beans, lima beans, cowpeas and "gallito" (*Agati grandiflora*); on wild eggplant, tobacco, tomato, eggplant and potatoes; on watermelon, squash, cucumber and cassava melon; on sugar-cane, grasses, asparagus, carrots, cotton and weeds, not only along the coast and on Mona Island, but also high in the mountains. Actually, we know little of its habits, for the nymphs have not been found in Puerto Rico. The earliest record, as *Agallia tenella* Ball, was reported by Mr. O. W. Barret (1904–448), of injurious abundance on beans, cowpeas and other plants. To date, no serious injury to hosts, or transmission of disease, has been proved, despite the numerous instances of temporary abundance of this leafhopper. While intensively searching for the possible vectors of mosaic disease of sugar-cane, and more recently, those of the

bunchy-top disease of papaya, all the species of these short, restless leafhoppers with no well defined host have been intensively collected.

Dr. P. W. Oman in his "Classification of the North American Agallian Leaf Hoppers" (Technical Bulletin No. 372, pp. 94, fig. 18, pl. 4, U. S. Dept. Agriculture, Washington, D. C., August 1933) describes one typically Puerto Rican species, collected in abundance in several citrus groves in the Bayamón region, as **Agallia configurata**. It is "yellow cinereous to dirty yellow, with color varying considerably in intensity, but the pattern is constant and quite distinctive." Altho the type is from Puerto Rico, it occurs in the Dominican Republic, in Trinidad and even in Brasil.

Adult of *Agallia albidula* Uhler, twelve times natural size.
(Drawn by G. N. Wolcott.)

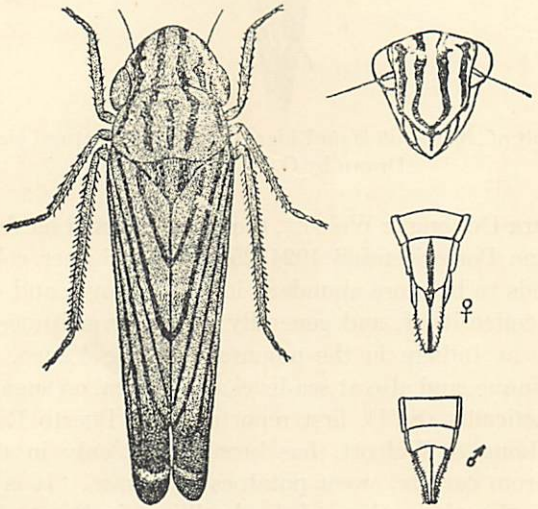
Agallia pulchra DeLong & Wolcott, the type collected on *Inga laurina* at Lares ("Insectae Portoricensis" 1924–259), has brighter colors than the others, and tends to be more abundant in coffee groves and on the tender growth of the coffee itself, and generally at higher altitudes, most abundantly perhaps at Indiera in the mountains above Yauco. It has been found on El Yunque, and also at sea-level at Guánica, on sugar-cane.

Agalliana sticticollis (Stål), first reported from Puerto Rico as *Agallia carrotovora* DeLong & Wolcott, has been found only in the San Juan region, swept from carrots, sweet potatoes and grass. It is much darker in general coloration than others of the Agalliinae in Puerto Rico.

Agalliopsis pepino, described as an *Agallia* by DeLong & Wolcott ("IP" 1924–258), the type from carpet grass (*Axonopus compressus*) at Ciales, others on sugar-cane at San Sebastián, has since been found at many localities, on various hosts and at light. Marked with black, its background is mauve to orchid, most obvious on the saddle on its back. Prof. J. H. Jensen (Mayagüez Station Report for 1937, p. 86) found it negative as vector of the bunchy top disease of papaya.

The very largest leafhopper ("length of male 9.75 mm.") in Puerto Rico is the pale green **Krisna insularis,** described by Dr. P. W. Oman (Pan-Pacific Entomologist, **12** (3): 118–9. San Francisco, Cal., July 1936) of which the type was collected by Dr. W. A. Hoffman on El Yunque, at light. Numerous subsequent collections have been made at light on El Yunque by Dr. Luis F. Martorell, and Prof. J. A. Ramos has swept them from herbage in the Maricao Forest. Aside from the "eyes and small areas around ocelli red or brown, anterior tibiae and tips of all tarsi tinged with reddish", these leafhoppers are "vividly virescent in life". An exceptionally large nymph, entirely light green, which is presumed to be of this species, was noted on *Eugenia stahlii* on the Mt. Britton trail, and this may be the normal host.

Idiocerus parvulus, described by Dr. Osborn (1935–132) from material at San Germán, is a much smaller pale green leafhopper, only 3 to 3.25 mm. long, noticeably colored with "a broad, pale orange spot partly divided on the median line" at the base of front. Prof. J. A. Ramos has made topotype collections, and also found it at Mayagüez and at Caguas.



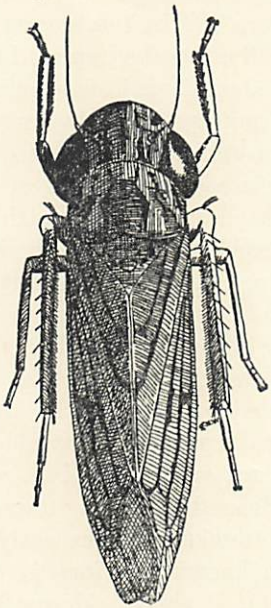
Adult of *Sibovia coffeaphila* (Dozier); ten times natural size.
(Drawn by H. L. Dozier.)

At present referred to the genus **Sibovia,** according to Dr. P. W. Oman, are three fine big leafhoppers of the Proconiinae, of which the two most common on coffee, and on other trees and shrubs of the coffee regions, were described by Dr. H. L. Dozier (Jour. Dept. Agr. P. R., **10** (3 & 4): 259–265, fig. 4. San Juan, September 1927) as **Cicadella coffeaphila** and **C. coffeacola.**

Subsequently, he (1931–6) transferred these to the subdivision *Entogonia*. Ecologically, these two are practically equivalent, both occupying the same niche and living on the same plants, but morphologically the latter is most obviously characterized by the black inverted Y on the back of its green head, rather than the more or less parallel black stripes of the other. Both are of the same intense shade of green. Dr. Osborn's **Entogonia lineata** (1935–136) from El Yunque is "fairly close" to the latter, but its stripes are narrower, and in life it is an opaque light yellowish green in color, quite different from the dense green of the other two. Subsequent collections have been made on "turma de toro" (*Clibadium erosum*) growing where the lower part of the Mt. Britton trail meets the jeep road to the radar station on El Yunque, the adults flying about from leaf to leaf much more actively than the coffee grove frequenting species. By comparison, these are inert, normally resting quietly on the stems or midribs of plants in considerable numbers. Nymphs associated with adults of *Sibovia coffeaphila*, and presumably this species, have been noted on *Heckeria peltata*, but this is not to be considered an exclusive host, for the stems of "fresas" (*Rubus rosaefolius*) and other valueless bushes occurring in coffee groves, as well as orange and "pomarrosa", also serve for them to rest and probably feed upon. Dr. Wetmore reports finding the bodies of 14 leafhoppers, identified as *Tettigonia* sp., in the digestive tract of the tody (*Todus mexicanus*). One of these birds collected by Dr. Luis F. Martorell in Bo. Maragüé, Ponce, had eaten seven leafhoppers which could be readily and definitely identified as *Sibovia coffeaphila*. If this is a minor pest of coffee, the presence of the tody is indicated as tending to produce effective control.

Poeciloscarta histrio (Fabricius), the presently accepted name for what for many years has been known as *Cicadella* or *Tettigonia sirena* Stål (= *T. interrupta* Signoret), is violet, old rose and purple marked with black, its head and the body beneath bright yellow. Of "The Minor Insects of Sugar-Cane of Porto Rico" (Jour. Dept. Agr. P. R., **5** (2): 1–47, fig. 19. San Juan, April 1921), it is by far the largest leafhopper to be found on young cane, but both nymphs and adults have been noted on other shrubs and plants and grasses, such as malojillo, gramma and sesame; on carrots, ñame and okra; on "cadillo" (*Urena lobata*), and bougainvillea vine; on "gallito" (*Agati grandiflora*), "almendra" (*Terminalia catappa*), coffee and grapefruit. Dr. Osborn (1929–93) found them on *Sesuvium* and *Barita*. "The nymphs have a median stripe of light yellow extending from the head to the tip of the abdomen, the younger ones being otherwise mostly dark brown, but the older ones are more yellowish brown, with various spots or stripes of darker yellow or brown, but nowhere showing the dark pink of the adults. In the field, there is no difficulty in connecting the nymphs with the adults, as they have invariably been found

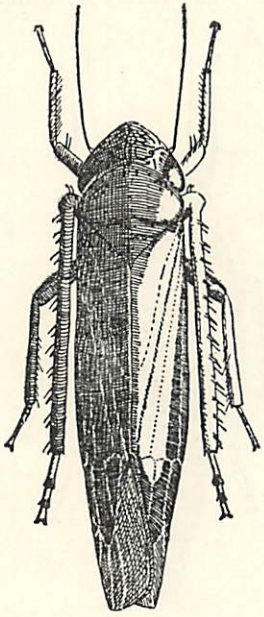
together." Altho no collections have been made east of Pt. Cangrejos, Río Piedras, Comerío and Aguirre, the leafhopper is common elsewhere in the Island along the coast, even in the more arid regions, as at Ponce, Guánica and Faro de Cabo Rojo, and in the lower foothills up to Lares and Adjuntas. In the damp gorge at Guajataca, numerous dead adults were found killed by an *Isaria* fungus, festooned on the stems of *Lantana camara*. On Mona Island, adults were abundant on *Ricinus communis*, on various other unidentified plants, and attracted to light at night.



Adult of *Poeciloscarta histrio* (Fabricius) (= *Cicadella* or *Tettigonia sirena* Stål) twelve times natural size. (Drawn by G. N. Wolcott.)

Rainfall and humidity determine the abundance of **Hortensia similis** (Walker) on sugar-cane and grasses. First reported by Mr. D. L. Van Dine (1911–31) as a *Tettigonia*, and most often since as a *Kolla*, this most common leafhopper to be normally found on sugar-cane in Puerto Rico was most intensively studied at the time of the rapid spread of mosaic disease, for it seemed to be the most likely vector of the disease. The adult is bright grass green, with a characteristic and very definite pattern in black on the head and prothorax. The eggs are laid in clusters of from three to seven in cane leaf tissue, and can easily be seen when the leaf is held up to the light. They are parasitized by *Brachistella prima* Perkins, *Ufens niger* Ashmead and *Oligosita comosipennis* Girault; those escaping

parasitism hatching in seven days. "The just hatched nymphs are opalescent, light creamy-yellow, with big, darker eyes and are first noted on the central whorl of the cane. They feed nearly half of the time. With their thick beak inserted in the cane plant, they let go with their legs, using them to get rid of the minute drop of colorless excrement which collects at the anus. With all their legs in motion at once and these little drops of moisture being hurled into the air at the rate of one every seven seconds, a colony of *Kolla similis* nymphs feeding is a most exciting spectacle."

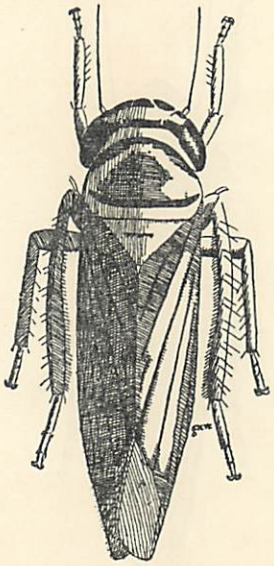


Adult of *Hortensia similis* (Walker), twelve times natural size.
(Drawn by G. N. Wolcott.)

All kinds of terrestrial and arboreal lizards feed on the adults, but no bird, nor the giant toad. Dead adults have been found apparently killed by a fungus, *Empusa muscae* Cohn. During dry weather, these leafhoppers apparently retreat to the wettest parts of malojillo meadows, but under favorable conditions of humidity they may be found in cane fields at Guánica, on the grasses around Cartagena Lagoon and even at Faro de Cabo Rojo. Prof. J. A. Ramos collected a single adult at light on Mona Island.

Kolla fasciata Walker (= *Kolla fuscolineela* Fowler), characterized by a head broadly banded with black and yellow, and pink beneath, normally lives on lawn and pasture grasses, such as St. Augustine, Bermuda and

carpet grasses, and only incidentally and accidentally on malojillo and young sugar-cane. Altho found near the coast, it tends to be more abundant in the hills, on pastures or patches of grass in coffee groves. Its nymphs are fluffy white, and often more abundant on a favored bit of lawn than are the adults. Being very sensitive to local humidity, it shows what has been termed a "Leafhopper Reaction to Lawn Sprinkling" (Jour. Ec. Ent., **33** (3): 584. Menasha, June 1940) so marked as to be very destructively abundant when this is artifically increased. It is eaten by the grass lizard often, and more rarely by other lizards.



Adult of *Kolla fasciata* Walker (= *Kolla fuscolineela* Fowler). Twelve times natural size. (Drawn by G. N. Wolcott.)

Carneocephala sagittifera (Uhler), in the earlier records called a *Draeculacephala*, was noted by Dr. Osborn (1929–93) as greatly preferring Bermuda grass, and numerous collections have been made on this host in all parts of the Island. It has been found on sugar-cane at Guánica and Hormigueros, but its presence on this host was largely accidental, having been forced by weeding. Characterized by a very sharply pointed head and a consistent pattern of black spots on head and scutellum, its wings vary in depth of intensity of their grey coloration. The grass lizard (*Anolis pulchellus*) eats these leafhoppers, and rather surprisingly, the iguana (*Ameiva exsul*) also catches them.

The females of **Xerophloea viridis** (Fabricius) are entirely green, with

their hyaline wings so tightly drawn together that the hind end of the body is very acute. The males are marked with reddish, and the ocelli are red. Altho a common continental species, in Puerto Rico it is but rarely noted. Dr. Osborn records it from Desecheo Island, and from Guánica, Ponce, Aguirre and Guayama. It is by no means confined to the xerophytic south coast, however, for Dr. Richard T. Cotton swept it from the patch of carrots at Rio Piedras which he found inhabited by so many different kinds of leafhoppers and other insects, and the crested lizard (*Anolis cristatellus*) also found it at Río Piedras.

Adult of *Carneocephala sagittifera* (Uhler), twelve times natural size. (Drawn by G. N. Wolcott.)

The only other representative of the Gyponinae in Puerto Rico is the much smaller **Xerophloea breviceps,** described by Dr. Herbert Osborn (1935–143) from a single male at San Juan, which "approaches the gray-colored male of *viridis*, but is much smaller, the vertex shorter and less angulate."

Xestocephalus pulicarius Van Duzee, 2.5 to 3 mm. long, is one of the smallest of the Euscelinae: minute brown leafhoppers, speckled with grey and white. It occurs at every elevation, from Pt. Cangrejos and Aguirre on the north and south coast, to Indiera in the mountains above Yauco, but is possibly most abundant in coffee groves. Altho comparatively few collections have been made by entomologists, all the arboreal lizards: *Anolis evermanni*, *A. pulchellus*, *A. krugii*, *A. stratulus*, *A. cristatellus* and *A. gundlachi*, were found to have eaten this little leafhopper. Presumably it is as abundant as their collecting indicates.

Xestocephalus pallidus, 2.5 mm. long, was described by Dr. Osborn (1935–146) from a single female collected on El Yunque.

Xestocephalus maculatus, 3.5 mm. long, was described by Dr. Osborn (1929–94) from an abundance of specimens found on *Inga vera* near Jájome Alto, shade trees for coffee groves since almost entirely destroyed by hurricane.

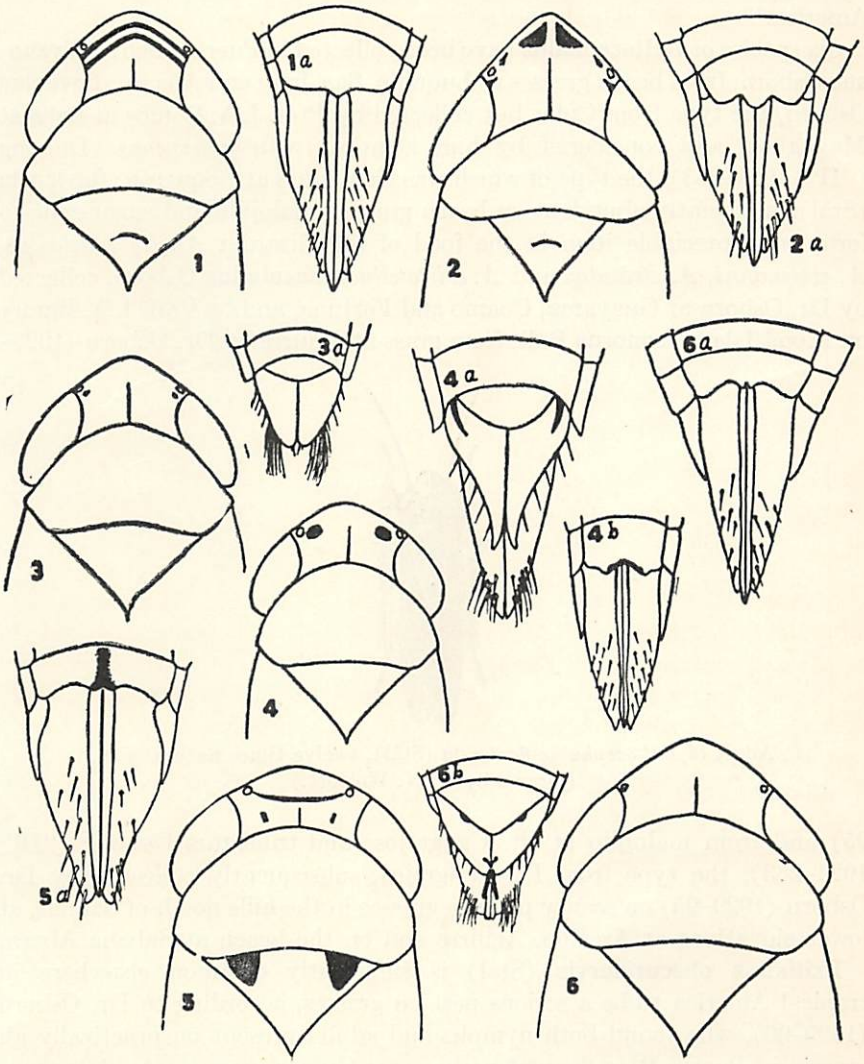
Adult of *Xestocephalus pulicarius* Van Duzee, twelve times natural size. (Drawn by G. N. Wolcott.)

By contrast with these quaint little spotted species, **Spangbergiella vulnerata** (Uhler) is one of the largest, the female having a remarkably broad and expanded head. Both sexes characteristically have orange-red, converging, diagonal stripes on a light green vertex and pronotum. They are sometimes attracted to light, and have also been noted on young cane, malojillo and other grasses, Dr. Osborn mentioning Guinea grass. Not at all abundant, the localities from which collections have been made are Camuy, Aguirre, Río Piedras, Loíza and Vieques Island.

Most remarkably patterned in yellow, brown and grey is **Sanctanus fasciatus** described by Dr. Osborn (1900–190) as a *Scaphoideus* from specimens from Haiti and many from the southern United States, and its Puerto Rican variety described by Dr. Osborn (1935–149) as **variabilis**, the type from Aguirre, others from Patillas.

Osbornellus bimarginatus, described by Dr. D. L. DeLong ("IP" 1924–261) as a *Scaphoideus*, the type from light at Pt. Cangrejos, was supposed to be only a coastal species, like those above, but Prof. J. A. Ramos has collected specimens in the Maricao Forest, as well as at Mayagüez.

The grey and yellow spotted **Scaphytopius loricatus** (Van Duzee), most recently collected by Prof. Ramos on Mona Island, and **Scaphytopius frontalis** (Van Duzee) have to date been found only near the coast in Puerto Rico. As a *Platymetopius*, Dr. Osborn (1935–150) records finding two specimens on waste land at Aguirre, and assigns to the latter the record "on string beans at Rio Piedras," very scanty records considering that



Leafhoppers illustrated in "Insectae Portoricensis" (1923–262).

1. *Osbornellus bimarginatus* (DeLong), 1a. female genitalia.
2. *Deltocephalus trilobatus* DeLong, 2a. female genitalia.
3. *Deltocephalus flaveolus* Osborn, 3a. male genitalia.
4. *Baldulus maidis* (DeLong & Wolcott), 4a. male genitalia, 4b. female genitalia.
5. *Chlorotettix nigromaculatus* (DeLong & Wolcott), 5a. female genitalia.
6. *Chlorotettix tethys* Van Duzee, 6a. female genitalia, 6b. male genitalia. (Drawn by D. M. DeLong.)

"the species is common over the southern United States and in Central America."

Six species of **Deltocephalus** have been collected in Puerto Rico: **albivenosus** Osborn, from beach grasses at Luquillo, San Juan and Añasco; **flaveolus** Osborn, the type from Cuba, but collected by Prof. J. A. Ramos at light at Mayagüez, and considered by him identical with *nigripennis* DeLong ("IP" 1924–263), the type of which was from grass at Boquerón; **flavicosta** (Stål), sufficiently abundant on beach grasses, malojillo and sugar-cane to form an appreciable item in the food of four lizards: *Anolis pulchellus*, *A. evermanni*, *A. stratulus* and *A. cristatellus;* **maculellus** Osborn, collected by Dr. Osborn at Guayama, Coamo and Fortuna, and by Prof. J. A. Ramos on Mona Island; **sonorus** Ball, from grass at Aguirre by Dr. Osborn (1929–

Adult of *Deltocephalus flavicosta* (Stål), twelve times natural size. (Drawn by G. N. Wolcott.)

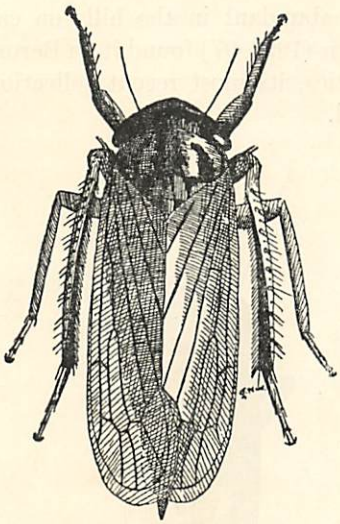
95) and from malojillo at Pt. Cangrejos; and **trilobatus** DeLong ("IP" 1924–263), the type from Pt. Cangrejos, subsequently collected by Dr. Osborn (1929–95) on scanty pasture grasses in the hills north of Salinas, at lower elevations at Arecibo, Aguirre and on the beach at Sabana Abaca.

Exitianus obscurinervis (Stål) is sufficiently common elsewhere in tropical America to be a serious pest on grasses, according to Dr. Osborn (1929–96), who found both nymphs and adults present on practically all grasses in Puerto Rico "except perhaps for Guinea grass." As *Athysanus exitiosus* Uhler, determined by Dr. J. D. Ball, it had earlier been recorded on sugar-cane at Patillas and Hatillo, so rarely indeed, as unquestionably not implicated in mosaic disease transmission.

Limotettix striolus (Fallen), identified in 1920 by Dr. D. L. DeLong as an *Euscelis* or *Athysanus*, was found in abundance on malojillo grass at Pt. Cangrejos, but has not since been collected.

Acinopterus angulatus Lawson, first reported from Puerto Rico as

Acinopterus acuminatus Van Duzee, determined by Dr. D. L. DeLong, swept from grass at Boquerón, was later collected by Dr. Osborn (1935–159) at Guayama and Salinas, and a single specimen from San Juan identified as this species.

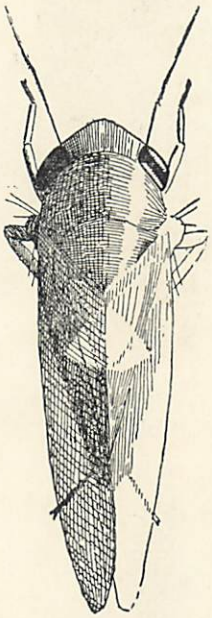


Adult of *Exitianus obscuriner.is* (Stål) (= *Athysanus exitiosus* Uhler), twelve times natural size. (Drawn by G. N. Wolcott.)

Adult of *Unerus colonus* (Uhler), twelve times natural size. (Drawn by G. N. Wolcott.)

Unerus colonus (Uhler), in earlier Puerto Rican records called a *Thamnotettix*, is distinctive with two small and two larger black spots on the vertex. It is quite common on all sorts of grasses, possibly the first record being of one individual, misidentified as *Tettigonia similis* Walker, reported by Dr. John R. Johnston as killed by *Empusa muscae*, one of "The Entom-

ogenous Fungi of Puerto Rico" (Bull. No. 10, Board of Commissioners of Agriculture, P. R., pp. 1–33, pl. 9, fig. 1. San Juan, 1915). As an indication of its abundance, one individual was collected in 3 square feet of pasture at Pt. Cangrejos, and it was found eaten by the grass lizard *Anolis pulchellus*, and by *Anolis krugii*. It occurs on young sugar-cane, and on malojillo, but is most abundant in the hills on carpet grass, *Axonopus compressus*. Dr. Osborn (1929–97) found it on Bermuda and St. Augustine grasses at many localities, its most recent collection being by Prof. J. A. Ramos on Mona Island.



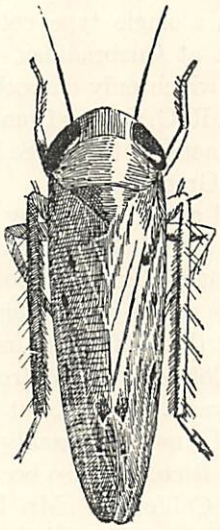
Adult of *Chlorotettix minimus* Baker, twelve times natural size.
(Drawn by G. N. Wolcott.)

Unerus cubanus (Osborn), described from Cuba as *Thamnotettix*, has smaller spots on its head and is generally much less abundant. Dr. Osborn (1929–97) collected it on grasses at Guayama and Aguirre, and Prof. J. A. Ramos found it on Mona Island.

Unerus comatus (Ball), described from Mexico as a *Deltocephalus*, was tentatively determined by Dr. D. L. DeLong as a *Thamnotettix* from Puerto Rican material. Dr. Osborn (1929–98) swept these yellow-green leafhoppers from grass at Bayamón and Arecibo. The spots on the vertex are smaller than those on *U. cubanus*, and much smaller than the larger pair on *U. colonus*.

Eutettix tenellus (Baker), the beet leafhopper of the western United States, according to Dr. P. W. Oman, (Proc. Ent. Soc. Washington, **38** (7): 164–5. Washington, D. C., October 1936), the *Thamnotettix rubicundula* Van Duzee of Jamaica, which Dr. Osborn (1929–98) collected on "verdolaga rosada", (*Sesuvium portulacastrum*) at Aguirre and Ensenada, has since been found at Boquerón on "verdolaga de mar" *Sesuvium maritimum*.

Graminiella nigrifrons (Forbes), a pale yellowish-green leafhopper with a blackened face, is a common continental species of which Dr. Richard T. Cotton swept a few specimens from carrots at Río Piedras and of which Dr. Osborn (1929–98) made collections at Santa Rita, Luquillo and Loíza Aldea.



Adult of *Chlorotettix tethys* Van Duzee, twelve times natural size.
(Drawn by G. N. Wolcott.)

Chlorotettix minimus Baker, a large pale green leafhopper, is often found on young sugar-cane, but is normally much more abundant on grasses, Dr. Osborn (1929–99) having collected it at many coastal localities.

Chlorotettix nigromaculatus DeLong & Wolcott ("IP" 1924–265), of which the type was collected at light at Río Piedras, was not found by Dr. Osborn, but Prof. J. A. Ramos has many specimens taken at light at various localities, including Mayagüez and Ponce.

Chlorotettix tethys Van Duzee, re-described from Puerto Rican specimens collected at Pt. Cangrejos and Guánica by Dr. D. L. DeLong ("IP" 1924–

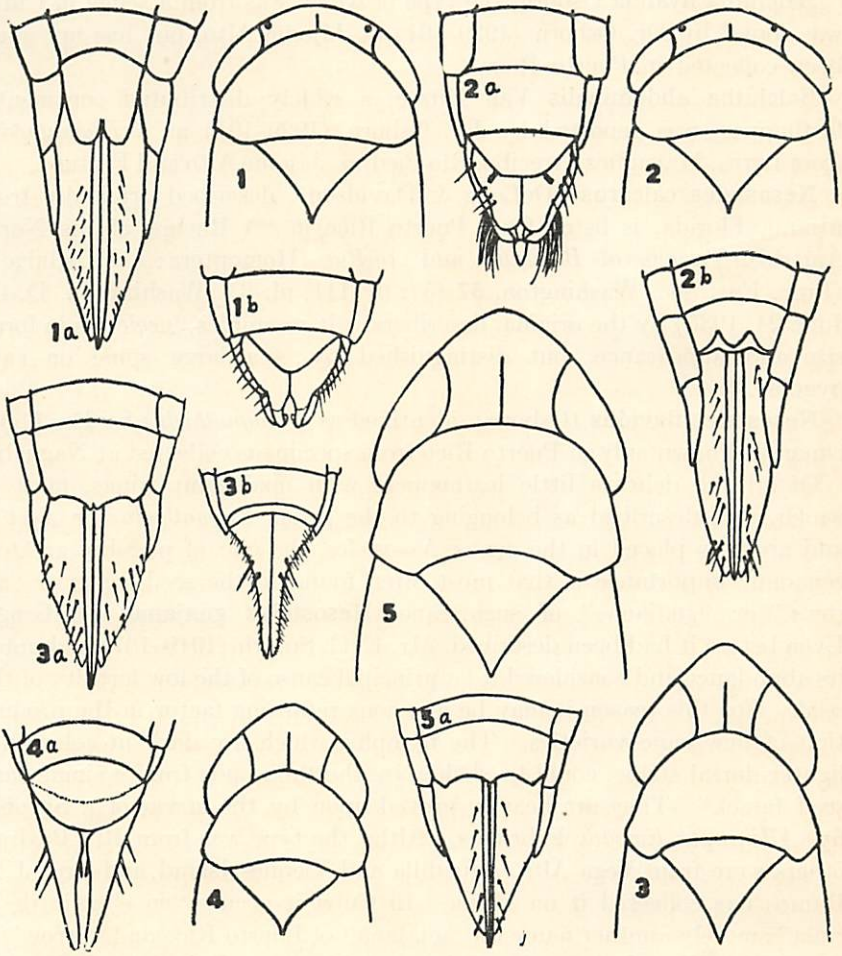
264) with the specific name of *bidentatus*, is light green in color, devoid of markings except for "more or less distinct fuscous or blackish spots on the elytra" according to Dr. Osborn (1929–99), who found the nymphs associated with adults on the mountainside of the Salinas valley, "bright green, no marking, with short scattered blackish hairs on abdomen". Adults do occur on young sugar-cane but are most abundant on grasses, and may occur on weeds and sweet potatoes. They have been found eaten by the grass lizard, *Anolis pulchellus*. Prof. J. A. Ramos found them on Mona Island.

Chlorotettix viridius Van Duzee, entirely light green in color, was first collected in Puerto Rico at light at Pt. Cangrejos, Dr. Osborn (1929–99) found only one specimen at Luquillo.

Jassus obligatus, described and figured by Dr. Osborn (1935–167), using Uhler's MS name, was from a single type collected on "jagüey" (*Ficus laevigata*) by G. N. Wolcott at Quebradillas. It is a large brown leafhopper, striped with red, of which only one other specimen has been collected in Puerto Rico, by Mr. R. G. Oakley from "roble" (*Tabebuia pallida*) in the Ponce region. Specimens in the U. S. National Museum bearing Uhler's MS name are from Grenada.

Baldulus maidis, described as a *Cicadula* by DeLong & Wolcott ("IP" 1924–265), first collected on corn at Haina, Dominican Republic in 1920, but the type from San Sebastián in Puerto Rico, on corn, may be identified by the two round black spots on the vertex, one just behind each ocellus. Corn is the normal host, but this leafhopper may also be found on young cane, and Dr. Richard T. Cotton swept it from carrots at Río Piedras. Dr. Osborn found it at Guayama on corn, but not elsewhere in the south coast, altho it is common and almost invariably present on this host on the more humid parts of Puerto Rico. It also occurs in Cuba, and has been accidentally introduced into California. Mr. D. B. Mackie, reporting in the "Insect Pest Survey" (14 (9): 284. Washington, D. C., November 1, 1934), found it "in the eight southern counties from Kern and Santa Barbara to the Mexican border". Most recently, Dr. P. W. Oman, reporting on the "Distribution of *Baldulus maidis* (DeLong and Wolcott)" (Proc. Ent. Soc. Washington, **50:** (2): 34. Washington, D. C., February 27, 1948), notes that this leafhopper has also been found in Arizona, Texas, Florida and North Carolina in the United States, and in Mexico, Costa Rica, Venezuela, Brasil, Perú and Argentina, being a pest of sugar beets at Tucumán. It seems highly improbable that it occurred in any of these continental countries originally, but the records of collection are too scattered to draw any conclusions as to the point of first introduction from the West Indies. Adults have been attracted to light, but nymphs occur mingled with the adults only on corn, often in sufficient numbers to caus-

injury comparable to that of the corn fulgorid. Both nymphs and adults are parasitized by a blue-green strepsipteran, and Dr. K. A. Bartlett reports *Gonatopus* near *bicolor* Ashmead, "A Dryinid Parasite attacking *Baldulus maidis* in Puerto Rico" (Jour. Agr. U. P. R., **22** (4): 497–8. Río Piedras, February 1938).



Leafhoppers illustrated in "Insectae Portoricensis" (1923–268).

1. *Nesosteles guajanae* (DeLong & Wolcott), 1a. female genitalia, 1b. male genitalia.
2. *Nesosteles incisa* Matsumura, 2a. male genitalia, 2b. female genitalia.
3. *Protalebra aureovittatus* (DeLong), 3a. female genitalia, 3b. male genitalia.
4. *Empoasca sexmaculata* DeLong, 4a. male genitalia.
5. *Joruma brevidens* (DeLong), 5a. male genitalia. (Drawn by D. M. DeLong.)

Macrosteles sexnotata (Fallen), in the earlier Puerto Rican records listed as a *Cicadula*, was first collected on sugar-cane at Patillas and Garrochales but its normal host is grasses. Dr. Osborn (1929–100) collected a possible variety at Jájome Alto, between Cayey and Guayama, of which the six spots on the vertex are "broader (and) more squarish".

Balclutha hyalina Osborn, the type of which was from a sedge in Cuba, was found by Dr. Osborn (1929–101) at Jájome Alto, but has not since been collected in Puerto Rico.

Balclutha abdominalis Van Duzee, a widely distributed continental leafhopper, was reported by Dr. Osborn (1929–101) as a *Eugnathodus* from Lares, Mayagüez, Arecibo, Río Piedras, Jájome Alto and Fortuna.

Nesosteles calcarus (DeLong & Davidson), described originally from Miami, Florida, is listed from Puerto Rico in "A Review of the North American Species of *Balclutha* and *Agellus* (Homoptera: Cicadellidae)" (Proc. Ent. Soc. Washington, **37** (5): 97–111, pl. 2. Washington, D. C., June 24, 1935) by the original describers. It resembles "*neglectus* in form, size and appearance, but distinguished by . . . a large spine on each pygofer."

Nesosteles flavidus (Osborn), identified as a *Eugnathodus* by Dr. P. W. Oman, is known only in Puerto Rico from specimens collected at Naguabo.

Of all the delicate little leafhoppers with opalescent wings, most of which were described as belonging to the genus *Eugnathodus* or *Agellus* and are now placed in the genus *Nesosteles*, the one of possibly greatest economic importance is that most often found in the seed-heads or "arrows" or "guajanas" of sugar-cane, **Nesosteles guajanae** (DeLong). Even before it had been described, Mr. E. G. Smyth (1919–107) had noted its abundance and considered it "a principal cause of the low fertility of the seed. For this reason it may be a serious retarding factor in the production of new cane varieties. The nymphs, which are dark in color with lighter dorsal stripe, could be shaken by the thousands from a single cane seed tassel." They are heavily preyed upon by the larvae of a Syrphid fly, *Allograpta limbata* Fabricius. Altho the type was from Río Piedras, others were from Vega Alta, Aguadilla and Vieques Island, and Prof. J. A. Ramos has collected it on Mona. In Cuba it occurs "en el güin de la caña": merely another name for "guajana" of Puerto Rico and "arrow" of the British West Indies. Dr. Osborn (1929–102) collected it "frequently in sweeping grass even when far distant from cane, and it seems evident that it is a general grass feeder and occurs on cane only when it is in bloom." It can hardly be common on grasses, for the grass lizard, *Anolis pulchellus*, was not observed to have eaten any leafhopper which could be identified as this.

Nesosteles incisa Matsumura first listed under this name by Dr. F. M. Wadley (1937–107) as being swept from grass in the Mayagüez region, was

described by Dr. D. L. DeLong ("IP" 1924–266) as *Eugnathodus bisinuatus* from a large series of specimens from seedheads of malojillo (*Panicum barbinode*) at Río Piedras, and had earlier been listed as *Balclutha osborni* Van Duzee on sugar-cane and malojillo. Incidentally and accidentally, it may also occur on other low vegetation, such as sedges, carrots and sweet potatoes, but is primarily a grass-infesting leafhopper, and as such is eaten by the grass lizard, *Anolis pulchellus*. Prof. J. H. Jensen (Mayagüez Station Report for 1937, p. 86) pronounced it negative as vector of the bunchy-top disease of papaya.

Nesosteles minutus, described by Dr. Osborn (1929–101) as a *Eugnathodus*, "from matted grass at sea level, salt flat association, at Aguirre" is 2.5 to 2.75 mm. long, the smallest of the genus, a pale ashy grey leafhopper, almost white. It has not since been found.

Nesosteles neglectus (DeLong & Davidson), a pale or dark brown leafhopper originally described from Mt. Manitou, Colorado and found in most of the United States, and the Canal Zone, was listed by Dr. Osborn (1929–101) from numerous localities in Puerto Rico under the name *Eugnathodus abdominalis* Van Duzee. Later (1935–176) he decided "the true *abdominalis* to be a *Balclutha*" and revised his records of collections to include only Aguirre, Fortuna and Arecibo.

Nesosteles pallidus (Osborn), which is not the DeLong & Davidson variety of their *neglectus*, is reported from Puerto Rico by Dr. Osborn (1929–101) as a *Eugnathodus*, from specimens collected at Río Piedras and later transferred (1935–174) to *Nesosteles*, with illustration and notes as to its pale olive green color, the elytra milky hyaline.

"From the seed heads of a sedge, *Fimbristylis spadicea*, at Aguirre" Dr. Osborn collected the types of **Nesosteles rosaceus** (1929–102), thus named because "the whole body above and beneath, as well as the elytra, (is) suffused with bright pink or reddish rose color". Originally called a *Eugnathodus*, Dr. Osborn (1935–175) is responsible for the generic transfer.

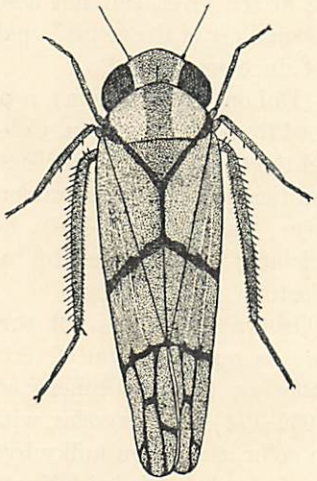
Nesosteles virescens, originally described by Dr. Osborn from Cuba as a *Eugnathodus*, was collected by him (1929–101) from the grass on the Station grounds at Río Piedras.

Of the delicate, small, milky whitish or light green Typhlocybinid leafhoppers, those of the genus *Protalebra* are usually specific on the leaves of a tree. Dr. D. L. DeLong ("IP" 1924–267) described **Protalebra aureovittatus,** as an *Alebra*, from a tree in Ciales which presumably was the "moral" (*Cordia sulcata*), as this leafhopper has repeatedly been collected since from this host: at Yabucoa, Río Grande, El Yunque, Cayey and Aguas Buenas.

Protalebra bifasciata Gillette, as determined by Mr. W. L. McAtee, was reported by Dr. H. L. Dozier (1927–261) "from a thorny leguminous bush in a ravine near Juana Díaz", but has not since been found.

Protalebra cordiae, described by Dr. Osborn (1929–102) from an abundance of nymphs and adults on the under side of the leaves of *Cordia* at Aguirre and Coamo, were presumably from "capá prieto" (*Cordia* or *Cerdana alliodora*), from which this leafhopper has since been collected at Cayey and San Lorenzo. It is mostly white, marked with yellow and orange, the elytra tinged with greenish; the nymphs are "white, faintly tinged with yellow, the eyes greenish white as in the adults".

Protalebra tabebuiae described by Dr. H. L. Dozier (1927–260) from an abundance of nymphs and adults living on the under side of the leaves of "roble" (*Tabebuia pallida* = *Tecoma pentaphylla*) at Río Piedras, has been



Adult of *Protalebra tabebuiae* Dozier, twenty times natural size. (Drawn by D. H. Dozier.)

repeatedly noted since on this host, not only at Río Piedras, but wherever the trees occur. At times it is so abundant as to produce a mosaic-like pattern on the leaves that finally blots out most of the normal dark green and causes some of them to drop long before they would normally do so. Those which continue to adhere, are badly spotted, or often entirely yellow. Following the first heavy spring rain that causes complete defoliation, a major infestation of leafhoppers often appears on the tender new leaves, producing feeding injuries even before they have attained full size. It has been suggested that this leafhopper may be the vector of the witches broom disease of roble.

Protalebra braziliensis Baker, first reported from Puerto Rico as *Erythroneura comes* Say, is a "brilliant little yellow-and-brown leafhopper with silvery spots in the brown blotches" which is sometimes very abundant on young sugar-cane in weedy, sandy fields in low places, especially where the

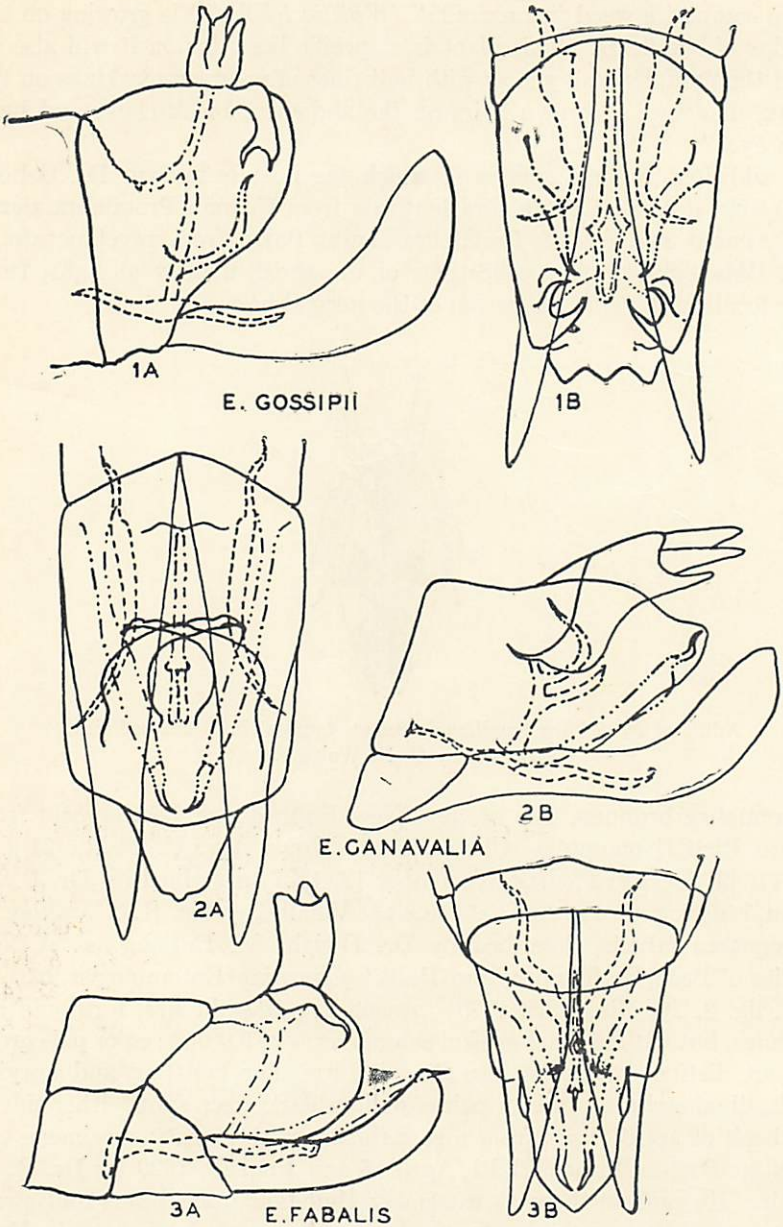
coarse composite weed "manzanilla" (*Wedelia trilobata*) is growing on the margins of the fields. This plant is a specific host, for on it will also be found the nymphs, "all yellow with indistinct olive-green markings on the thorax, five rows of brown hairs on the abdomen, black claws and light green eyes".

In addition to these species of which the host is known, Dr. Osborn (1929–103) described **Protalebra lenticula** from Coamo, **Protalebra ziczac** from Añasco, and records **Protalebra similis** Baker from sweet potato at Vega Baja. Subsequent collections of the three, usually at light, from other localities give no indication of the normal host.

Adult of *Protalebra braziliensis* Baker, twelve times natural size. (Drawn by G. N. Wolcott.)

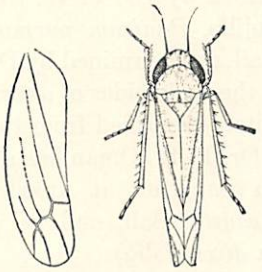
Protalebra brunnea, one of the "New Eupterygine Leafhoppers from Puerto Rico (Homoptera: Cicadellidae)" (Jour. Agr. U. P. R., **21** (4): 567–71, pl. 1. Río Piedras, November 12, 1937) described by Dr. P. W. Oman, is dark brown in color, collected at Villalba by Mr. R. G. Oakley.

Empoasca fabalis, described by Dr. Dwight M. DeLong as "A New Species of Bean Leafhopper from Haiti" (Canadian Entomologist, **62** (4): 92–3, fig. 2. Orillia, April 1930) "resembling *fabae* in size, form and appearance, but with distinct genital characters; size 3.0 mm; color pale green without distinct markings, usually with irregular mottling and varying longitudinal stripes, white; a pair of oblique dark green spots either side of and back of apex" was "from a series of more than sixty specimens collected at Port-au-Prince, Haiti, April 15 and June 18, 1929 by Dr. R. C. Smith. He reports these as extremely abundant upon beans and sweet potatoes and the most important species of economic leafhopper in Haiti upon truck crops". As is noted by Dr. John S. Caldwell in discussing "The Synonymy of *Empoasca fabalis* DeLong (Cicadellidae: Homoptera)" (Jour. Agr. Univ. P. R., **31** (2, April 1947): Río Piedras), the common leaf-



Lateral and ventral views of male genitalia of three species of *Empoasca* leafhoppers originally described from Haiti by Dr. D. M. DeLong, two of which are known to occur in Puerto Rico. (Drawn by D. M. DeLong.)

hopper on beans in Haiti, as in Puerto Rico, is *fabae* (Harris), and that on sweet potatoes and morning glory in Haiti, as in Puerto Rico, is what was subsequently identified as *batatae* Poos, which is a synonym of *fabalis* DeLong. Indeed, this is indicated in the confused records, Dr. Herbert Osborn (1935–185) noting that "the species is abundant and injurious on sweet potato, beans, morning glory, etc., etc.," which is quite correct if the record of beans is omitted, for late identifications have been made by Dr. P. W. Oman of leafhoppers from sweet potatoes, and from morning glory, as being *batatae* Poos. Three years after the description of *Empoasca fabalis* was published, Dr. F. W. Poos described his *batatae* from "a large series of specimens reared on sweet potato at Arlington, Va., and from specimens collected as nymphs from the same host plant at Fort Myers, Florida. Specimens were also received from Brasil, collected on cotton,



Forewing and adult of *Empoasca fabalis* De Long, ten times natural size. (U. S. Bureau of Entomology.)

grohoma, legumes and sweet potato". The record on cotton presumably refers to what is locally called "algodão brava", which, illogically enough, is in fact a morning glory, *Ipomaea fistulosa.*

Empoasca fabae (Harris) is the common bean leafhopper. The enormous numbers in which this small, light green leafhopper occurs is the main reason why beans can not be grown at sea level in the West Indies during the summer. Presumably a very exact temperature relation is involved, for beans do well in the winter along the coast, and at all times of year in the mountains. But summer temperatures in the lowlands of Puerto Rico appear to be optimum for a tremendous increase in abundance of these iridescent and opalescent-winged leafhoppers, which directly by their feeding, and indirectly by transmitting a presumed mosaic disease, prevent beans from reaching maturity. In the report by Drs. Roger C. Smith & H. D. Barker on their "Observations on the "Yellows" Disease of Beans and related Plants in Haiti" (Jour. Ec. Ent., **23** (5): 842–7, pl. 1. Geneva, October 1930), they did not prove that the real cause is a virus of which the leafhopper is merely the vector, but merely suggested that probability.

Beans have many advantages as a catch crop in gran cultura plant cane, but in young plant cane in the spring and early summer, they are often a total loss. Spraying with Bordeaux mixture as often as on potatoes might be equally effective, but can hardly be justified economically. Spraying or dusting with DDT and some of the other newer insecticides is so effective in control of leafhoppers that it is now possible to grow beans at all times of the year at sea level in the tropics, but this is such a recent development that few growers have attempted it commercially.

A comparable yellowing and shedding of leaves is caused by this leafhopper on the leguminous tree "gallito" (*Agati grandifiora*). Premature defoliation of small-seeded lima beans (Mayagüez Station Report for 1939, p. 60) is also caused by this leafhopper, but plants of the large-seeded lima beans were apparently uninjured. Altho beans are the normal host of this species, individuals identified by Dr. P. W. Oman have been taken from melon, tomato and malojillo, *Panicum purpurascens*.

Empoasca minuenda Ball, as determined by Dr. H. L. Dozier (1927–261), was found "abundant on the undersides of avocado leaves at Río Piedras", having been earlier definitely identified from this host at Río Piedras, and subsequently at Loíza. Dr. P. W. Oman has also identified as this species specimens intercepted on grapefruit at Arecibo, on "maga" (*Montezuma speciosissima*) as var. *moznetti* Ball, and as doubtfully this species on "anona blanca" (*Annona diversifolia*).

Empoasca sexmaculata was described by Dr. D. M. DeLong ("IP" 1924–270) from a pair on "emajagua" (*Pariti tiliaceum*), at Pt. Cangrejos, out of large numbers noted causing yellowing of the leaves, with large and small nymphs also present. This characteristic yellowing together with the accompanying leafhoppers, will be noted on almost every plant in all parts of the Island where it grows.

Empoasca papayae was described by Dr. P. W. Oman (1937–570) from specimens collected at Mayagüez on papaya (*Carica papaya*) by Dr. J. H. Jensen, who, however, failed to implicate them in the transmission of the bunchy top disease of the host. Subsequently, Mr. José Adsuar was able to prove the "Transmission of Papaya Bunchy Top by a Leafhopper of the Genus *Empoasca*" (Science, **103** (2671): 316. Lancaster, March 8, 1946) using individuals collected on papaya at and near Río Piedras. The females of this species are practically indistinguishable from others of the genus. By etherizing mass collections of leafhoppers from papaya, Mr. Francisco Seín was able to separate out males of *Empoasca papayae*, and using these males only as vectors, transmission of the disease was obtained. (Science, **106** (2745): 130. Baltimore, August 8, 1947). As these leafhoppers are generally not at all abundant on papayas growing near the beach, on such plants the disease seldom appears. At Río Piedras the disease is severe, leafhoppers being very abundant at times, altho periods

of scarcity also occur. Farther inland, as at Toa Alta, Comerío, Corozal, Caguas and Cayey, the leafhoppers have been noted in greatest abundance. This is not altogether a matter of altitude, for at Punta Borinquen Air Base, at an elevation of several hundred feet, but close to the ocean, very few leafhoppers were to be found on universally healthy papayas. Dusting healthy papaya plants, when small, with 5% DDT at intervals of two weeks is effective in killing the leafhoppers, or preventing their becoming abundant, and it is anticipated that such DDT-treated plants should be able to attain maturity and produce fruit without becoming diseased. Miss Vera K. Charles has identified as *Empusa spiculata* Thaxter, var. *major* a fungus killing these leafhoppers, which may be partly responsible for their scarcity under conditions and in regions where one might expect them to be numerous.

The type of **Empoasca insularis,** described by Dr. P. W. Oman as one of "New Neotropical Empoascan Leafhoppers" (Jour. Washington Academy of Science, 26 (1): 34–40, fig. 2. Washington, D. C., 1936), is from Puerto Rico.

In "Studies on the Host Plants of the Leafhoppers of the Genus *Empoasca*" (Technical Bulletin No. 850, U. S. Dept. Agr., pp. 51, fig. 21, ref. 130. Washington, D. C., May 1943), Drs. F. W. Poos and N. H. Wheeler record from Puerto Rico **Empoasca sativae** Poos from *Centrosema* and *Indigofera*, and quote records by Dr. Osborn of **Empoasca fabae** Harris definitely identified by Dr. D. M. DeLong from Lares and Cataño, and of **Empoasca gossypii** DeLong on cotton at Añasco.

The type of **Joruma brevidens,** described as an *Empoasca* by Dr. D. M. DeLong ("IP" 1924–269) was from young coffee leaves at Indiera, in the mountains north of Yauco. The single specimen collected by Dr. Osborn (1929–105) was at Loíza Aldea, sweeping the river margin near caña brava, indicating a wide range in ecological habitats.

The type of **Joruma neascripta,** described by Dr. P. W. Oman (1937–568), was collected on "icaco" (*Chrysobalanus icaco*) at Manatí.

Joruma pisca McAtee, as determined by Mr. W. L. McAtee, was collected by Dr. H. L. Dozier (1927–262) at Aguirre.

Largely eliminating the West-Indian cedar or "cedro" (*Cedrela odorata* or *Cedrela mexicana*) from consideration as an economic tree in Puerto Rico is another of these little light green leafhoppers, first noted as a serious pest here, and described by Dr. P. W. Oman (1937–569) from a great abundance of material collected at Doña Juana (Villalba), Aibonito and Maricao Forest as **Dikraneura cedrelae.** It becomes so abundant on the underside of cedro leaves as to cause their premature yellowing and shedding everywhere that this tree has been planted by the Forest Service. The caterpillars of the mahogany shoot borer, *Hypsipyla grandella* Zeller, also attack young cedro trees. The combined effect of attack by two pests:

one causing premature shedding of the leaves, the other causing low branching, effectually prevent the cedro from rapidly developing marketable lumber anywhere in Puerto Rico. The shoot-borer is cosmopolitan, but the leafhopper occurs elsewhere only in Cuba, where it is considered but a minor pest.

As **Dikraneura centrosemae** (the specific name mis-spelled *lentrosemae* in the text of the original description) Dr. P. W. Oman (1937–568) described the leafhopper which Dr. F. M. Wadley had swept from *Centrosema* at Mayagüez.

Dikraneura marginella Baker was swept from grass at Río Piedras by Dr. Osborn (1929–106).

Often very common on the underside of the leaves of "maga" (*Montezuma speciosissima*) are the red, white and blue nymphs and the bright colored adults of **Dikraneura (Hyloidea) depressa,** described by Mr. W. L. McAtee (Jour. N. Y. Ent. Soc., **34** (2): 162. New York, 1926). The types were collected at Vega Alta, and subsequent collections at Bayamón, Toa Alta and Arecibo, from this normal host, and others at Arecibo on grapefruit were identified by Dr. P. W. Oman as being this species.

Dikraneura (Hyloidea) delicata, described by Dr. Osborn (1935–190) from numerous examples at Cayey and a few at Yabucoa, has a "smooth, shining, waxy white appearance, without dots or spots except faint flecks at the tip of elytra in apical cells". "The food plant was not recognized."

Hybla maculata, described by Mr. W. L. McAtee in "A New Neotropical Genus Eupteryginae (Homoptera) from Porto Rico" (Jour. Dept. Agr. P. R., **16** (2): 119–20, fig. 1. San Juan, July 1932) from the leaves of "mamey" (*Mammea americana*) at Barceloneta, others at Pt. Cangrejos, has more recently been found in great abundance, as determined by Dr. J. S. Caldwell, on "emajagua" (*Pariti tiliaceum*) at Cayey, and also on Mona Island.

Typhlocybella minima Baker was collected by Dr. Osborn (1929–106) on Guinea grass at Aguirre and from other grasses at Yabucoa, Río Piedras and Arecibo. It is once recorded on malojillo at Bayamón, and Dr. F. M. Wadley (1937–107) swept it from *Bradburya* at Mayagüez.

Fulgoroidea: Planthoppers

The so-called sugar-cane leafhopper of Hawaii, *Perkinsiella saccharicida* Kirkaldy, which for a time was such a serious pest of sugar-cane there, is, strictly speaking, not a leafhopper at all, but belongs to the family Delphacidae, of the superfamily Fulgoroidea, the members of which, by analogy, should be called planthoppers. As so much intensive study was centered on this one economic pest in Hawaii, naturally the entomologists there became specialists in the Fulgoroidea, and when authoritative

identifications of Puerto Rican planthoppers were desired, the entomologists of the Hawaiian Sugar Producers' Experiment Station could identify the known species, or promptly describe the new forms. Thus, **Parahydriena hyalina**, the type from coffee at Lares, was described by Mr. F. Muir (Proc. Hawaiian Ent. Soc., for 1923, **5** (3): 461–472, pl. 1. Honolulu, 1924) from a single specimen collected by Mr. Francisco Seín. It is by no means abundant, but Dr. H. L. Dozier (1931–14) reports specimens collected at Arecibo and Mayagüez, and Prof. J. A. Ramos has specimens from the Maricao Forest.

Catonia antillicola, described by Dr. H. L. Dozier ("IB" 1936–92) from two specimens collected by Dr. R. T. Cotton at Río Piedras, is known only from the types.

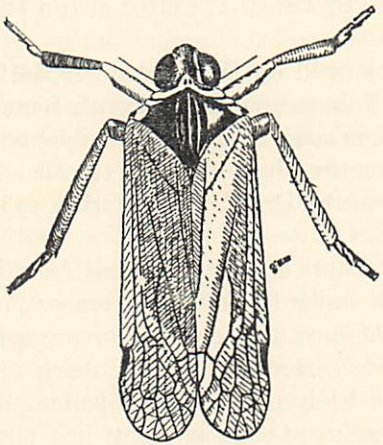
Catonia cinerea, described by Dr. Osborn (1935–195) from two specimens, from Lares and Yabucoa, was subsequently found at several localities on the north coast and on maga at Arecibo, on hibiscus at Mayagüez.

Catonia intricata, described by Uhler from the Island of St. Vincent, was collected from El Yunque by Dr. W. T. M. Forbes, as identified by Dr. Osborn (1935–195).

Bothriocera undata Fabricus, first identified from Puerto Rico by Dr. P. W. Oman, and very similar to *Bothriocera venosa* Fowler of Mexico and Central America, is the most common large representative of the family Cixiidae, characterized, according to Dr. Osborn (1935–196) by being "usually slender,...with elytra or wings hyaline, or slightly clouded, and with a median ocellus at apex of front, just above the base of the clypeus". Its clear, dark-veined wings and body with bluish-grey bloom, "scutellum ferrugineous, with three keels," are quite distinctive, the brown nymphs having warts on head and thorax and long iridescent spicules at caudum. Usually living in a humid environment, it is susceptible to attack by fungi. Mr. J. A. Stevenson in his "Check List of Porto Rican Fungi, and a Host Index" (Jour. Dept. Agr. P. R., **2** (3): 125–264. San Juan, July 1918) records individuals resting on *Palicourea crocea* killed by *Isaria saussurei* Cook, and Miss Vera K. Charles later identified a fungus attacking them as *Hirsutella citriformis* Speare. They ar also caught and eaten by the crested lizard, *Anolis cristatellus*. Sometimes these planthoppers are found on sugar-cane, but that is hardly a normal host, and they are most often noted on the underside of leaves or on the fleshy stems of such rank weeds as *Piper adunctum* and *Heckeria peltata* in coffee groves, and in undisturbed environments along the coast, on wild orange trees, on seagrape (*Coccoloba uvifera*) and in mangrove swamps. They may occur on coffee trees and on coffee shade trees, but preferably on wild trees, such as "laurel sabino" (*Magnolia splendens*) on El Yunque, and "grayumo" (*Didymopanax morototoni*) at Lares. Mr. E. G. Smyth (1919–

146) reports collection on Vieques Island, but no collections have been made on Mona, altho Dr. Osborn implies "an extended distribution in the Neotropics, including the West Indies, Fowler (having) described the species from Guatemala".

Bothriocera bicornis (F.), as identified by Mr. W. L. McAtee, was intercepted on grapefruit at Arecibo and on banana at Mayagüez. It has much darker wings, as shown in the illustration by Mr. R. G. Fennah in "The Fulgoroidea, or Lanternflies of Trinidad, and adjacent Parts of South America" (Proc. U. S. National Museum, **95** (3184): 411–520, pl. 10. Washington, D. C., 1945).



Adult of *Oliarus franciscanus* Stål, twelve times natural size.
(Drawn by G. N. Wolcott.)

Oliarus franciscanus Stål is a somewhat smaller, hardier and more abundant Cixiid at the lower elevations in Puerto Rico, its black body in life having a grey bloom, the five keels on the mesonotum not prominent. Originally described from San Francisco, California, it has a wide distribution thruout the tropics, and, as noted by Dr. Osborn (1929–106) "has received several Latin names due to this wide distribution", among which are *cinereus* Wolcott (1921–18) on sugar-cane in Puerto Rico, and *complectus* Ball, the name given by Dr. P. W. Oman in identifying the specimens collected by Prof. J. A. Ramos on Mona Island. Mr. Francisco Seín, (1929–90) in search for a possible vector of sugar-cane mosaic, found that the nymphs are subterranean, and feed on the roots of sugar-cane and malojillo, thus accounting for the numbers of adults often to be seen on young cane, as well as on other incidental hosts. The somewhat gregarious nymphs are whitish, covered with waxy-white fluff, the surplus of which lines the cavity in the soil where they are feeding on the sugar-cane rootlet.

No apparent injury due to their presence is to be noted in the cane plant, and even when the adults are most abundant, no indication of their feeding on cane leaves can be seen. Accidentally and incidentally, adults have been noted resting on a wide variety of other plants, rarely in the mountains, but everywhere in the coastal regions, including Guánica. Dr. Wetmore found them eaten by the tody (*Todus mexicanus*), and they are so preferred by lizards as to constitute 5% of the food of the grass lizard, *Anolis pulchellus*.

Pintalia alta, described by Dr. Osborn (1935–200) from specimens collected at El Yunque, Lares, Aibonito and Coamo Springs, (but none from Vega Alta or Toa Alta or Trujillo Alto) despite its apparent abundance, has not since been found, and we know nothing of its host relationships.

Pintalia infuscata and **Pintalia maculata** were described by Dr. Osborn (1935–199) from specimens collected on El Yunque, and **Pintalia decorata** Uhler identified by him from a single specimen from Lares.

Myndus obscurus Uhler, as identified by Mr. W. L. McAtee, has been collected from pumpkin at Las Marías, and what may possibly be this species from El Yunque.

Cubana tortriciformis was described by Mr. F. Muir (1924–461) from a single specimen on El Yunque taken at about 3,000 feet elevation, just below the first look-out, at the spring below El Yunque rock. This may possibly be the same as one of this genus collected on hibiscus at Mayagüez.

From light traps run by the U. S. Public Health Service on El Yunque, Mr. J. Maldonado collected specimens identified by Dr. J. S. Caldwell as being a species of **Achilorma** near *fowleriana* (Kirkaldy).

Ladella pallida, originally described as a *Monopsis* from Jamaica by Mr. R. Walker, was first identified from Puerto Rico by Dr. H. L. Dozier, on malojillo at Río Piedras, and subsequently he (1931–14) found specimens that had been collected for the American Museum of Natural History from Mayagüez, Maricao, Aibonito and Coamo Springs.

Ladella acunae Metcalf & Bruner was identified by Dr. Osborn (1935–204) from a single specimen from Coamo Springs.

Tangia (or **Neurotmeta**) **angustata** Uhler is a large, clear-winged, light green Tropiduchid, of which "the green nymphs, with a brush of widely-diverging, transparent-iridescent spicules at caudum, have been reared to adult on coffee". Adults have been noted on various trees in coffee groves, on all the shade trees: *Inga vera*, *Inga laurina* and *Erythrina glauca*, as well as those incidentally present, like wild orange and "jagüey" (*Ficus laevigata*) and on fleshy weeds, such as pokeweed (*Phytolacca decandra*) and "baquiña" (*Heckeria peltata*). Dr. Osborn (1935–206) doubtfully records collection from *Guilandina crista*, from near San Juan. They are much more abundant in the high mountainous coffee groves, as at Indiera, but

did occur in the coffee grove near Río Piedras, before that was cut down to plant in sugar-cane.

Tangia (or **Neurotmeta**) **sponsa** Guérin-Méneville, the common Cuban species, but also rarely found in Puerto Rico, on guava (*Psidium guajava*) at Aibonito, has a less sharply angled vertex than *angulata*.

Tangia (or **Neurotmeta**) **viridis** Walker, a smaller species with vertex rounder but much shorter, is primarily a costal species, having been repeatedly collected on seagrape (*Coccoloba uvifera*) at Loíza and Mameyes, and once on grapefruit at Vega Baja. Rather doubtfully, Dr. Osborn (1935–204) records collections at Aguirre and Salinas, from "mangle de botón" (*Conocarpus erecta*), which appears quite probable as Dr. Luis F. Martorell found one at the lighthouse on Mona Island.

Thionia borinquensis, described by Dr. H. L. Dozier as one of some "New and Interesting West Indian Homoptera" (American Museum Novitates No. 510, pp. 24, fig. 18. New York, December 15, 1931) from specimens collected at Aibonito, is a typical thick-set, short-bodied Issid. Light brown in general color, the nymphs have prominent orange coxae, exceptionally broad bodies and short wings margined in cream, and have been noted in abundance on seagrape (*Coccoloba uvifera*) at Loíza and Mameyes, together with a few adults. It is probable that other species of *Coccoloba* serve as hosts, for interceptions have been made at Cidra and Adjuntas.

Colpoptera brunneus, described by Mr. F. Muir (1924–465) from Utuado, others from Toa Alta and Ciales, is primarily a mountainous species, found in coffee groves, on coffee and on grass and weeds in coffee groves.

Colpoptera carinata, described by Dr. Dozier ("IP" 1936–99) from a great variety of hosts and at localities from Maní beach at Mayagüez to El Yunque, may be distinguished "by the very prominent, humped mesonotum with elevated carinae".

Colpoptera maculata, also described by Dr. Dozier (1931–21) from an equally extensive list of localities, including Mona Island, is more spotted, shining, dark brown; "the most abundant species of *Colpoptera* in Puerto Rico". Judging by the varied hosts to which it is doubtfully assigned, it is a general feeder, most specimens having been "swept from weeds".

Colpoptera maculifrons, described by Mr. F. Muir (1924–466) from Río Piedras, is primarlily a coastal species, found on seagrape (*Coccoloba uvifera*) at Pt. Cangrejos, and in orange groves and "pomarrosa" thickets in the foothills.

Colpoptera flavifrons, described by Dr. Osborn (1935–212) from St. Croix and Antigua, admittedly very similar to *maculifrons*, was found in abundance by Prof. J. A. Ramos (1947–21) on Mona Island.

Neocolpoptera portoricensis, described by Dr. H. L. Dozier (1931–22) from Aibonito, has since been found on "pomarrosa" at Cidra, and on "ausubo" (*Mimusops* or *Manilkara nitida*) at San Lorenzo.

Neocolpoptera monticolens, described by Dr. Dozier (1931–24) from Aibonito, others from Cayey and El Yunque, has since been found on guava (*Psidium guajava*) at Bayamón, and on "laurel sabino" (*Magnolia splendens*) on El Yunque, the young trees planted along the road to the recreation area being heavily infested at times.

In contrast to all these blunt-winged species, **Rhynchopteryx salina,** described by Dr. H. L. Dozier as "A New Fulgorid from Puerto Rico" (Jour. N. Y. Ent. Soc., **35** (1): 53–4, fig. 2. New York, 1927), has wings finely tapering to a point. The type was found on "barilla" (*Batis maritima*) and "cariaquillo" (*Lantana camara*) near the salt ponds west of Guánica, and others at Ponce, Arroyo and Mameyes.

Prof. J. A. Ramos, in his master's thesis on "The Insects of Mona Island, West Indies" (Jour. Agr. U. P. R., **30** (1): 1–74, pl. 2, ref. 45. Río Piedras 1947) proposes and describes the new genus *Paraprosotropis*, closely related to *Prosotropis* Uhler of the family Kinnaridae from the Lesser Antilles, for his yellow, chrome and orange-colored **Paraprosotropis monensis,** the type of which he collected on Mona Island.

Quilessa tristis from El Yunque, **Quilessa fasciata** and **Quilessa pellucida** from the Maricao Forest are other Kinnarids from Puerto Rico, described by Mr. R. G. Fennah (Psyche, **52** (1 & 2): 119–138. Cambridge, May–June 1945), all having been collected by Dr. P. J. Darlington. All except *Quilessa fasciata*, which is mostly yellow or brownish, are "piceous, membrane of abdomen red", which will explain the sad names given these inhabitants of the high tropical rain forests.

Adult of *Acanalonia servillei* Spinola, a Hispaniolan species, not found in Puerto Rico, three times natural size. (Drawn by Fritz Maximilien.)

Acanalonia brevifrons, described by Mr. F. Muir (1924–467) from a single male collected in the Seboruco woods near Laguna San José, has since been found on Mona Island by Prof. J. A. Ramos (1947–20).

Acanalonia coniceps, described by Dr. Osborn (1929–108) from specimens swept from bushes and coarse grasses at Salinas, has the "flattened

margins of the vertex converging to an acute tip". It has since been found on beefwood or Australian pine (*Casuarina equisetifolia*) at El Verde.

Acanalonia viriditerminata (Lethierry), with doubly carinate and even more acute tip, originally from Guadeloupe and Martinique, is reported by Dr. Dozier (1931–13) from El Yunque and Aibonito. All three Acanaloniids have large, broad, opaque green wings, and as found in Puerto Rico are quite rare.

Acanalonia pumila Van Duzee, by comparison with the three large green species, is small and insignificant, but Prof. J. A. Ramos found the greyish adults and nymphs abundant on Mona Island, on the characteristic hairy grey beach plant "té del mar" (*Mallotonia gnaphalodes*). Despite careful and repeated search, it has not been found on this host anywhere in Puerto Rico.

Philatis agilis, originally described as a *Batusa* from Puerto Rico by L. Melichar (Annalen des K. K. Naturhistorischen Hofmuseums, **16:** 192. Berlin, 1901), is doubtfully associated by Dr. Osborn (1935–218) with green individuals, the vertex tinged with reddish brown, from El Yunque and Naguabo.

Chlorochara vivida (Fabricius), also previously noted by Melichar from Puerto Rico, Dr. Osborn (1935–219) identifies with specimens from El Yunque and Mameyes.

Mr. R. G. Fennah in his "Notes on the Flatid Genus *Ormenis* in the British Lesser Antilles and Trinidad, with Descriptions of New Species (Homoptera: Fulgoroidea)" (Proc. Ent. Soc. Washington, **43** (9): 193–210, pl. 2. Washington, D. C., December 29, 1941) compares Puerto Rican specimens of these very common, broad and opaque winged Flatids and finds that the two most often collected: *marginata* and *pygmaea*, are the same, but all are distinct from the many new species which he describes from the smaller islands. This merely confirms Dr. Osborn's quotation (1935–221) from Dr. Oman "that he finds *marginata* and *pygmaea* merge in coloration and that the males have similar genitalia". Adults of both are largely bluish-grey, or light greenish-yellow in color, and sometimes occur in enormous numbers in all parts of the Island, as well as on Mona, especially on seagrape (*Coccoloba uvifera*), "cariaquillo" (*Lantana camara*), coffee trees and jasmin vines. They are well known to anybody with jasmin vines about the house, for they almost invariably infest this plant, shriveling the tender shoots by feeding on them and covering them with a waxy white fluff deposited over the egg-clusters, or surrounding the wingless nymphs. The adults take to flight when disturbed, or with care may be chased around a stem by gentle pursuit with a lead pencil, but the nymphs can be disturbed with difficulty, for their retreat is the surrounding mass of fluff. Spraying with nicotine sulfate, one part in a thousand of water, is

temporarily effective in control, but nothing but repeated spraying will prevent the eventual return of others to your jasmin vines.

Despite their abundance on coffee, no appreciable damage is caused, possibly in part because in the humid environment of the typical coffee grove, many may be killed by entomogenous fungi: *Metarrhizium anisopliae* and *Isaria* sp., as identified by Miss Vera K. Charles. It is on the beach, however, that **Ormenis marginata** Brunnich (= **O. pygmaea** Fabricius) occurs in millions, vast clouds of them flying up from seagrape branches that one may disturb around Isabela and Quebradillas, and especially on the public road from Guajataca down to the beach. Naturally, lizards feed on them, especially the arboreal crested lizard, *Anolis cristatellus*, and even the iguana, *Ameiva exsul*. Dr. Wetmore found that many birds had eaten these little moth-like insects: the tody, hummingbirds, vireos, five warblers, the reinita, the redstart, cliff swallow, flycatcher, pewee, the grasshopper sparrow and even the mozambique. Nymphs of the golden-eyed *Chrysopa* suck the juice from the nymphs, the maggots of the Syrphid fly, *Baccha parvicornis* Loew, and possibly others, are predaceous on the nymphs, but most important of all is the Scelionid wasp, *Phanurus flavus* Dodd, which parasitizes the egg-masses, and is sometimes so abundant that one can with the greatest difficulty find an egg-mass that is not parasitized.

Besides this one common and variable species, Dr. Osborn records (1935–223) finding **Ormenis roscida** Germar, Mr. W. L. McAtee determined a specimen collected on tamarind at Mayagüez as **Ormenis pruinosa** Say, and Mr. F. Muir (1924–469) described from weeds at Vega Baja and coffee at Lares what he named **Ormenis pseudomarginata**. A recently revived generic name for these species is **Petrusa**, or **Petrusina.**

Melormenis antillarum Kirkaldy, in the earlier records from Puerto Rico called *Ormenis quadripunctata* Fabricius, is a brownish species with one large dark brown spot on each wing, beside one more smaller and less obvious. It has been collected on "cucubano" (*Coccoloba laurifolia*) on Mona Island, and on a great variety of hosts, such as "aguacate", coffee, "icaco" (*Chrysobalanus icaco*), castor bean (*Ricinus communis*), "saraguaso" (*Cordia corymbosa*) and "cariaquillo" (*Lantana camara*), at various localities in Puerto Rico, in grapefruit groves and in cane fields, possibly breeding on these plants. Dr. Osborn (1929–109) found it exceptionally abundant on "péndula" (*Cithrarexylum fruticosum*) trees near Salinas. On all of these hosts, and on seagrape (*Coccoloba uvifera*), it does not ordinarily mingle with *Ormensis marginata*, and is usually much less abundant than this common species.

Ormenis infuscata Stål, first identified from Puerto Rico by O. Heidemann, is possibly the darkest, but with the narrow outer margins of its

wings almost white. Nymphs and adults were found on sugar-cane under an aguacate tree by Mr. Thos. H. Jones, but no confirmatory collections on this economic host have since been made. It has been collected on grapefruit at Vega Baja, Vega Alta, Manatí, Arecibo and Añasco, and on guava (*Psidium guajava*) at Arecibo.

The very largest Fulgorid found in Puerto Rico, or at least the one with the largest wings, is the ghostly **Flatoides torttix** Guérin-Méneville, originally described from Cuba; a most striking example of camouflage with outspread, grey or greenish-brown wings, their outer margin wavy, looking like a flake of bark on the trunk of a tree of seagrape (*Coccoloba uvifera*) along the coast, or, more rarely in the mountains, on the trunk of some other smooth-barked tree.

Flatoides punctata (Walker) is somewhat smaller and more bluish-grey, with wings more smoothly margined, but not quite so smooth as in the illustration published by Dr. Osborn (1935–224), who found it on fiddlewood (*Cithrarexylum fruticosum*) at Salinas. Numerous specimens have been collected on Mona Island, some of which were identified by Dr. P. W. Oman, on "cucubano" (*Coccoloba laurifolia*) and other smooth-barked trees of the plateau, as well as attracted to light and on seagrape (*Coccoloba uvifera*) on the beach.

Flatoides angulifera was described by Dr. Osborn (1935–225) from a single, light grey specimen, "probably greenish in life", collected by Dr. Richard T. Cotton on coffee at Aibonito.

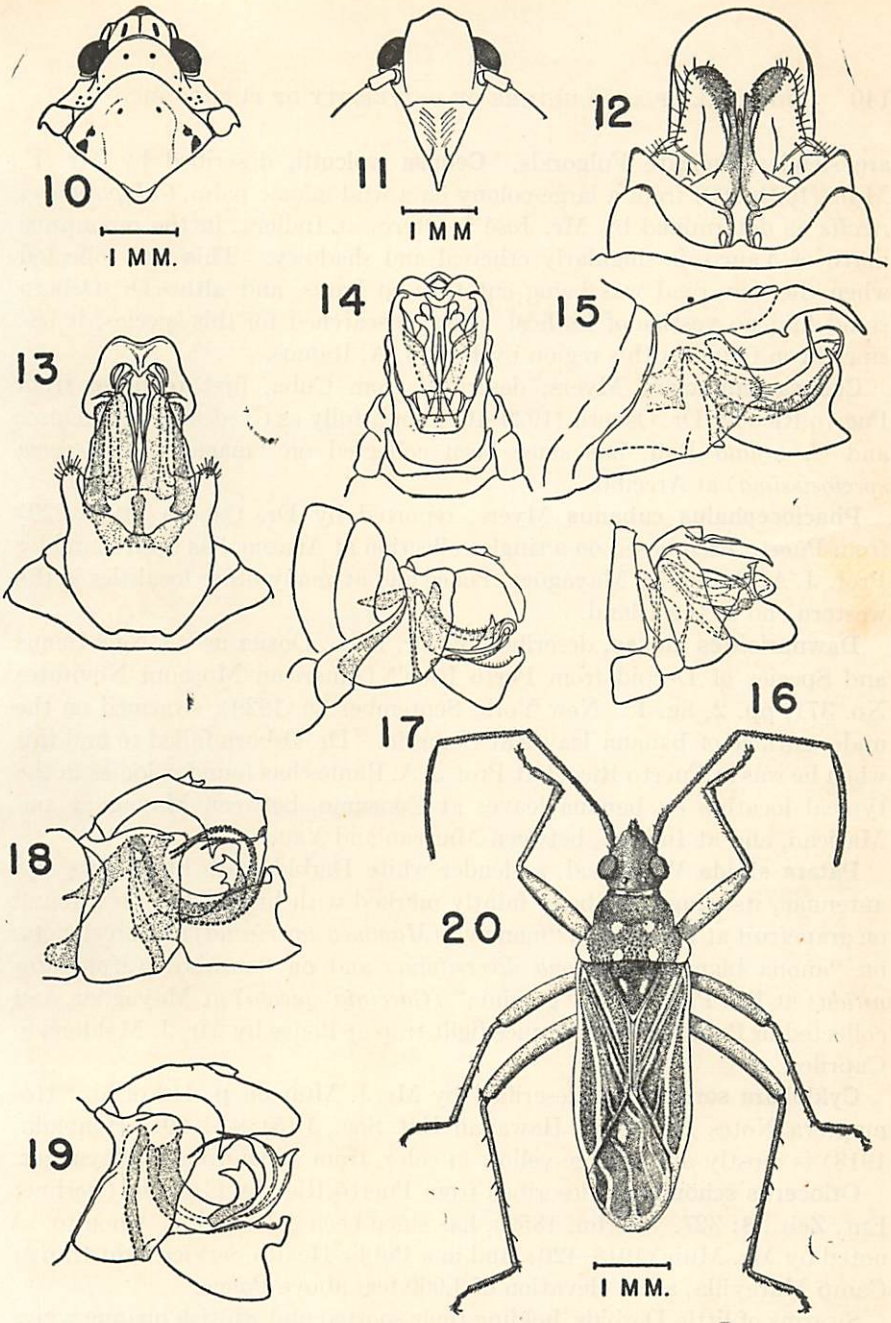
Flatoides brunneus Muir, as determined by Dr. P. W. Oman, has been collected on the coffee shade trees, *Inga vera* and *Inga laurina*, at Mayagüez and at Aibonito.

Flatoidinus fumatus, according to Prof. Ramos, was described from Puerto Rico by Melichar as *Dascalia fumata* in his "Monographie der Acanaloniiden und Flatiden (Homoptera)", the type and a single specimen reported to be in the Signoret collection in the Royal Museum of Vienna.

Rather abundant on "corcho" (*Pisonia albida*) of Mona and on the frangipane or "alhelí" (*Plumeria obtusa*) of the plateau, and also at light on the beach, is a brown and somewhat spotted species, almost entirely lacking in waxy bluish-white bloom, which Prof. J. A. Ramos described on page 19 of his master's thesis "The Insects of Mona Island, West Indies" (Jour. Agr. U. P. R., **30** (1): 1–74, pl. 2, ref. 45. Rio Piedras, 1947) under the name **Flatoidinus pseudopunctatus.**

Mingled with these on the same hosts on Mona Island, one also finds another slightly larger brown species, with four prominent black spots on the posterior margin of the pronotum, suggesting the specific name of **quadripunctatus** and only somewhat less well-marked spots on the wings.

By contrast with these large, broad-winged Flatids, the typical Derbids



Fulgorids from Mona Island: 10, *Flatoidinus pseudopunctatus* Ramos; dorsal view of head and thorax, 11. Frontal view of head, 12. Ventral view of female genitalia, 13. Ventral view of male genitalia, 14. *Melormenis antillarum* Kirkaldy; ventral view of male genitalia, 15. *Flatoidinus pseudopunctatus* Ramos; lateral view of male genitalia, 16. *Colpoptera flavifrons* Osborn; lateral view of male genitalia, 17. *Melormenis antillarum* Kirkaldy; lateral view of male genitalia, 18. *Petrusa marginata* Brunnich; male genitalia of dark form, 19. Male genitalia of pale form, 20. The Lygaeid Bug, *Ozophora octomaculata* Ramos, from Mona Island. (Drawn by J. A. Ramos.)

are slender, delicate Fulgorids. **Cedusa wolcotti,** described by Mr. F. Muir (1924–462) from a large colony on a wild manac palm, *Calyptronoma rivalis* as determined by Mr. José I. Otero, at Indiera, in the mountains north of Yauco, is singularly ethereal and shadowy. This was collected when the new road was being cut thru to Lares, and altho Dr. Osborn could find no vestige of its host when he searched for this species, it has since been found in this region by Prof. J. A. Ramos.

Cedusa santaclara Myers, described from Cuba, first reported from Puerto Rico by Dr. Osborn (1929–107) doubtfully as *C. edentula* Van Duzee and *C. inflata* Ball, has since been collected on "maga" (*Montezuma speciosissima*) at Arecibo.

Phaciocephalus cubanus Myers, reported by Dr. Osborn (1935–229) from Puerto Rico based on a single collection at Añasco, has been found by Prof. J. A. Ramos at Mayagüez, Ponce and at many other localities in the western end of the Island.

Dawnarioides musae, described by Dr. H. L. Dozier as "A New Genus and Species of Derbid from Porto Rico" (American Museum Novitates No. 371, pp. 2, fig. 1. New York, September 26, 1929), swarmed on the under surface of banana leaves at Comerío. Dr. Osborn failed to find this when he was in Puerto Rico, but Prof. J. A. Ramos has found colonies in the typical location on banana leaves at Consumo, between Mayagüez and Maricao, and at Indiera, between Maricao and Yauco.

Patara albida Westwood, a slender white Derbid, with black eyes and antennae, its wings and body faintly marked with brown, has been found on grapefruit at Dorado, on "mamey" (*Mammea americana*) at Barceloneta, on "anona blanca" (*Annona diversifolia*) and on "ausubo" (*Manilkara nitida*) at Río Piedras, on "garcinia" (*Garcinia spicata*) at Mayagüez, and collected in Public Health Service light trap at Ponce by Mr. J. Maldonado Capriles.

Cyklokara sordidulum, described by Mr. J. Muir on p. 416 of his "Homoptera Notes II" (Proc. Hawaiian Ent. Soc., **3** (5): 414–29. Honolulu, 1918) is mostly dull orange-yellow in color, from Aibonito and Mayagüez.

Otiocerus schönherri, described from Puerto Rico by C. Stahl (Berliner Ent. Zeit., **3:** 327. Berlin, 1859), has since been collected at Aibonito, as noted by Mr. Muir (1918–420), and in a Public Health Service light trap at Camp Maravilla, at an elevation of 3,900 feet above Ponce.

Swarms of little Derbids, holding their spotted and whitish opaque wings extended horizontally like those of dragonflies, resting at the base of the coffee shade trees, *Inga vera* and *Inga laurina*, at Río Piedras in August 1923, were described by Mr. Muir (1924–462) as **Dysimia maculata.** Prof. J. A. Ramos has since found them on "garcinia" (*Garcinia spicata*) at

Mayagüez, and they have come to Public Health Service light traps on El Yunque and in the mountains north of Ponce.

Copicerus irroratus Schwarz is possibly the most striking of all the Araeopidae (Delphacinae), "at once recognized by the greatly elongated and foliaceous antennae as shown in the figure" given by Dr. Osborn (1935–235) illustrating the single specimen which he collected at Añasco in 1929.

Stobaera tricarinata Say is known from Puerto Rico from a single specimen collected by Dr. Osborn (1929–110) at Aguirre.

Ugyops granulata is described by Dr. Osborn (1935–236) from a single specimen collected on El Yunque.

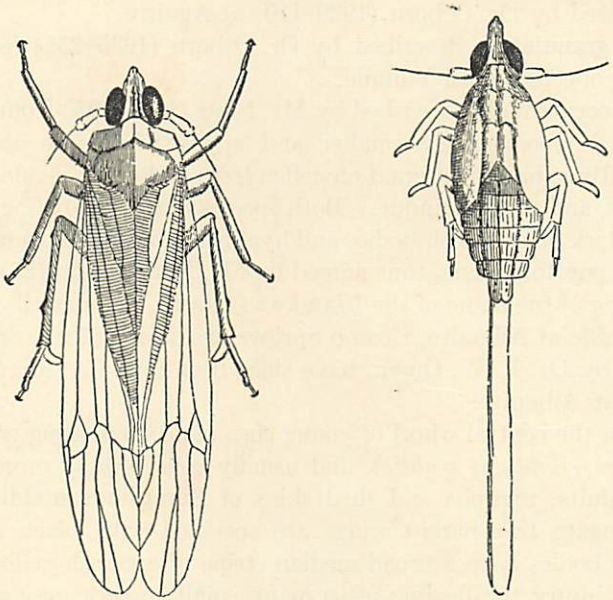
Ugyops occidentalis, described by Mr. Muir (1918–425) from a pair from Aibonito, is considerably smaller and apparently more abundant, as subsequently it has been found on coffee trees and coffee shade trees in the mountains, and on El Yunque. Both species have two distinct carinae on the face, dark or brownish bodies and hyaline, transparent wings.

Punana puertoricensis, thus named by Mr. Muir (1918–425) long before this spelling of the name of the Island was official, was described from collections made at Aibonito, Coamo Springs and Mayagüez. Specimens, as identified by Dr. P. W. Oman, have since been found on guava (*Psidium guajava*) at Aibonito.

Down in the central whorl of young corn plants, mingling with the corn leafhoppers (*Baldulus maidis*), and usually considerably more abundant, are the adults, nymphs and shed skins of **Peregrinus maidis** Ashmead. Their elongate transparent wings are speckled with black and brown; their dark bodies have a broad median stripe of greenish-yellow. Besides the direct injury the feeding of so many small insects may cause to the corn plant, these Araeopids have proved to be the vector of the yellow stripe disease of corn, a virus disease similar to, but quite distinct from the mosaic disease of sugar-cane. Dusting with $1\frac{1}{2}$ per cent of nicotine dust will control them, but in practise the corn plants have such superabundant vigor that they normally survive the heaviest infestations without the need for artificial control. Dr. Richard T. Cotton (1918–291) studied their life-history, and Mr. Francisco Seín suggested the common name: "El Peregrino del Maíz".

Almost the first entomological reference in the history of Barbados is of a black blight of sugar-cane, little understood at the time, which we now know was caused by multitudes of a pale Niagara green Delphacid (Araeopid), **Delphax saccharivora** Westwood, feeding on the cane leaves and excreting a somewhat sticky liquid on those below in such abundance as to furnish a favorable medium for the growth of sooty mold fungi. The

fungi are not pathogenic, but when the black crust on the leaves becomes thick, it shuts off the sunshine from the leaves, and prevents the synthesis of sugar by the cane plant. The insect, in some of the more recent literature discussed under the generic name of *Stenocranus* or *Saccharosydne*, is present thruout the West Indies wherever sugar-cane is grown. It has at various times been a most serious pest in Jamaica and Hispaniola, mass attacks on young plant cane removing so much cell sap from the leaves that the entire shoot withers and dies; the seed piece also being killed eventually



Adult and nymph of *Delphax saccharivora* Westwood, twleve times natural size (Drawn by G. N. Wolcott.)

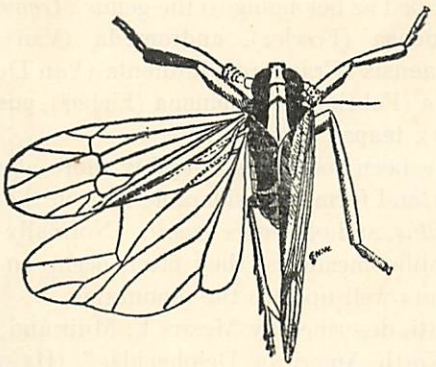
as each new leaf it puts out is attacked. In Puerto Rico, the insect is present in every cane field, more abundantly in those which receive ample rainfall, but very rarely in any great numbers because of natural parasites which keep its number reduced to a minimum. The eggs are attacked by a Mymarid wasp, *Anagrus armatus* Ashmead, the nymphs and adults by an undetermined Dryinid, and by a Strepsipteran, *Stenocranophilus quadratus* Pierce, the latter being more abundant and killing off more of these Delphacids than all other of its parasites and incidental predators combined. The eggs are deposited in a slit in the cane leaf, which is sealed with some of the whitish fluff from the rear end of the body of the female. The opalescent greenish nymphs feed on the underside of the cane leaves, developing long filaments of white wax, living gregariously and quietly,

with often a few of the active adults still present. While natural control by parasites has always been effective in Puerto Rico, in others of the West Indies, artificial control by dusting with powdered calcium cyanide is very successful and prompt in its action.

Megamelus elongatus Ball, a dirty, straw-colored Araeopid with a very elongate and pointed vertex, has been collected on beach grass at San Juan by Dr. Osborn (1929–110).

Sogata approximata Crawford, as determined by Mr. F. Muir, occurs in malojillo meadows and on grasses in and near cane fields of vegas of the north coast. Dr. P. W. Oman twice identified specimens intercepted on squash.

Sogata aurantii Crawford, as identified by Dr. Osborn (1935–244), was found in February 1912 by Mr. Thos. H. Jones breeding on Guinea grass in considerable numbers, both nymphs and adults being present, attended by the "hormiga brava" (*Solenopsis geminata*).



Adult of *Sogata cubana* Crawford, (= *Megamelus flavolineatus* Muir), twelve times natural size. (Drawn by G. N. Wolcott.)

Sogata cubana Crawford (= *Megamelus flavolineatus* Muir), the "white-lined planthopper of sugar-cane" as Mr. E. G. Smyth (1919–148) called it, is at times quite abundant on sugar-cane, sufficiently so as to form an item in the food of the grass lizard, *Anolis pulchellus*. It occurs in all parts of the Island, Dr. Osborn (1929–111) finding it at Jájome Alto, and collections have been made on beans at Aibonito, on rice at Río Piedras, and on carrots. On young cane it was found in great abundance, averaging one insect per shoot at Garrochales on April 19, 1920, and at Ponce on March 17, 1920, and in lesser numbers at Guayama, Patillas, and at numerous points on the north coast.

Of **Sogata cubana,** Dr. Osborn (1935–243) described a varietal form, **pallida,** swept from grass at Fortuna.

Sogata furcifer Horvath, as determined by Dr. P. W. Oman, has been swept from grass at Bayamón, and found resting on "cariaquillo" (*Lantana camara*) at Loíza. Dr. Osborn (1935–243) collected it at Río Piedras, and Prof. J. A. Ramos on Mona Island.

Sogata parvula Osborn, was collected by Dr. Osborn (1935–245) at Arecibo, and the males described from Puerto Rican specimens.

Liburniella fasciatella, described by Dr. Osborn (1935–246) from Jájome Alto, others from San Juan, swept from grasses, has not since been collected.

The wings of adult Delphacids of the genus **Pissonotus** are very short. From Puerto Rican material Dr. Osborn (1935–247) described **Pissonotus albovenosus,** which has the veination of the wings outlined in white, and **Pissonotus striolus** which has "elytra with areoles fuscous and veins broadly yellowish".

Usually longer wings, but even shorter bodies characterize the eleven species of **Delphacodes** collected from grass in Puerto Rico: most of which were originally described as belonging to the genus *Megamelus* or *Liburnia:* **Delphacodes albolineosa** (Fowler), **andromeda** (Van Duzee), **detecta** (Van Duzee), **havanaensis** (Crawford), **lutulenta** (Van Duzee), **nigripennis** (Crawford), **pellucida** (Fabricius), **propinqua** (Fieber), **puella** (Van Duzee), **humilis** (Van Duzee), **teapae** (Fowler).

The two last have been found considerably more abundant in Puerto Rico than the others, and form a considerable item in the food of the grass lizard, *Anolis pulchellus*, and of *Anolis krugii*. Normally found on pasture grasses and in malojillo meadows, they often occur on young cane and resting on other plants well up into the mountains.

Nilaparvata wolcotti, described by Messrs F. Muir and W. M. Giffard in their "Studies in North American Delphacidae" (Hawaiian Sugar Producers' Expt. Station Bull. No. 15, Entomological Series, pp. 53, pl. 6. Honolulu, January 16, 1924) from a pair from malojillo at Pt. Cangrejos, and a male from sugar-cane at Barceloneta, has since been found on malojillo at Bayamón.

Psylliidae: Jumping Plant Lice

The small, active winged adults of the Psylliidae are the forms least often noted, but the large gall-like pits in leaves, each one of which is occupied by a wax-exuding nymph, are most conspicuous. Indeed, the entomologist most readily identifies the tree called "tortugo amarillo" in Puerto Rico and "caya amarillo" in Santo Domingo (*Sideroxylon foetidissima*) by the deep pits in its leaves caused by the nymphs of **Ceropsylla sideroxyli** Riley, which are almost invariably present on every tree in Puerto Rico and on Mona Island.

Ceropsylla martorelli, described by Dr. John S. Caldwell and named

after the collector, in "New Psyllidae from Puerto Rico, with notes on others (Homoptera)" (Jour. Agr. U. P. R., **26** (2): 28–31, pl. 1. Río Piedras, July 31, 1942) is another species of the same genus, the nymphs of which attack the leaves of "laurel geo-geo" (*Ocotea leucoxylon*). The type is from Aguas Buenas and Cayey, but later collections have been made at Jayuya and in the Maricao Forest, indicating insular distribution in the mountains where the host grows. "The gall is the open pit type with the immature psyllid fully exposed on the under side of the leaf. The adult psyllids are only found during the rainy season when the tree puts out new shoots. Apparently the eggs are laid on the tender foliage and the immatures develop with the leaves."

Arytaina unga was described by Dr. Caldwell (1924–30) from a single female collected by Dr. Herbert Osborn at Mayagüez, of which the "general color (is) dull orange with light stripes on dorsum of thorax and on center of vertex. Antennae annulate with black, two terminal segements black".

Arytaina (or **Euceropsylla**) **cayeyensis,** described by Dr. Caldwell from material collected by Dr. Herbert Osborn at Jájome Alto (above Cayey) on coffee shade trees (*Inga* sp.), has since been found on *Chinchona* spp. in the mountains back of Mayagüez by Messrs. H. K. Plank and H. F. Winters, and also **Euceropsylla russoi** Boselli. Its "general color (is) straw yellow over all with indications of broad white stripes on the thorax; five terminal antennal segments black."

The coffee shade tree *Inga vera* has its tender leaves often infested with another psyllid, identified by Mr. W. L. McAtee in 1922 as **Psylla minuticona** Crawford, a light green species that exactly matches in color the light green leaves on which it exists. **Psyllia martorelli**, described by Dr. John S. Caldwell (Jour. N. Y. Ent. Soc., **52** (4): 335–41. New York, December 1944) from fresh material collected at Villalba on the same host, presumably is the correct name for this misidentified Psylliid. They are so abundant as to be a considerable item in the food of the arboreal lizards of coffee groves: *Anolis gundlachi* and *Anolis evermanni*. The largest ladybeetle found in Puerto Rico, the chestnut-brown *Daulis ferruginea* Olivier, often occurs in association with these Psylliids, and presumably feeds upon them. This ladybeetle, previously found only in the coffee groves of the mountains, has recently been noted in a logwood forest at Guánica, and, on closer examination, it was found that the leaves of logwood (*Haematoxylon campechianum*) were heavily infested with Psylliids, the identity of which is given by Dr. J. S. Caldwell as **Heteropsylla fusca** Crawford.

Heteropsylla puertoricoensis was described by Dr. Caldwell (1942–28) from material collected by Dr. Richard T. Cotton on *Pithecolobium saman*.

Heteropsylla mimosa Crawford, as determined by Mr. W. L. McAtee, infests the "aroma" or "salcilla" (*Acacia* or *Vachellia farnesiana*) of the

south coast. Millions of the minute greenish nymphs and transparent-winged adults occur on the tender shoots, curling and distorting the leaves and causing many of them to fall.

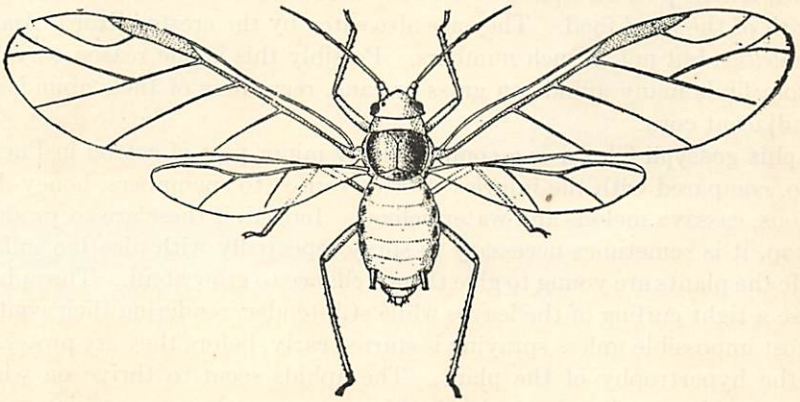
Carsidara concolor Crawford, collected by Dr. Herbert Osborn at Aguirre and at Río Piedras, was identified by Dr. Caldwell (1942–28).

The most mystifying manifestation of any of the Psylliids is the irregular shaped, granular, whitish waxy mass surrounding the nymphal skins of what in 1923 Mr. W. L. McAtee identified as **Euphalerus nidifex** Schwarz, which occur on the leaves of practically every shrub or tree of "ventura" (*Ichthyomethia* or *Piscidia piscipula*), no matter where it may be growing: Cabezas de San Juan, Luquillo, Pt. Cangrejos or Yauco and Boquerón.

Aphididae: Aphids

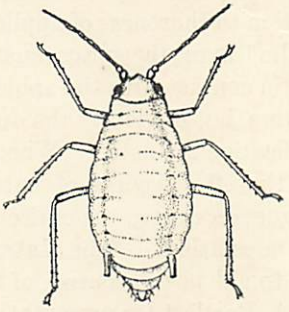
The aphids of Puerto Rico are all cosmopolitan species, not one originally described from specimens collected here. Dr. Stephen A. Forbes, who laid the foundations of economic entomology and scientific and applied ecology in the State of Illinois, described **Sipha flava** from sorghum and broom corn in 1883. In Puerto Rico it is primarily a pest of sugar-cane. Admittedly, the yellow aphid of sugar-cane does occur on sorghum, when that crop is grown in Puerto Rico, but its normal and preferred alternate host is lemon grass (*Cymbopogon citratus*). The introduced Java grass (*Polytrias amaura*) is as subject to yellow aphid infestation as it is to attack by chinch bugs, and the specialists in soil conservation have also found this aphid on *Digitaria sanguinalis* and on a species of *Eragrostis*. On sugar-cane, *Sipha flava* lives in colonies on the underside of the leaves towards the tip. Feeding of the aphids causes the tip to turn yellow and reddish, and eventually brown, from which the colonies gradually migrate down towards the stalk. A heavy infestation causes the entire leaf to dry up, and may even destroy an entire planting of young cane, or, more rarely, even young ratoons. The Uba cane, introduced at the time of the most rapid spread of mosaic disease and resistant to it, is most susceptible to attack by *Sipha flava*, and when the aphids have become very abundant on Uba, they may start new colonies on high cane of other varieties in the neighborhood. Such infestations in high cane may persist for months, being practically impossible to control artificially, and less subject to natural control than if they were on small cane and close to the ground. Aphids have many predaceous and parasitic enemies in Puerto Rico, as elsewhere (see Circ. No. 59, Estación Experimental Insular, Río Piedras, pp. 11, fig. 9. San Juan, 1922) but most of these are also parasitized, and rarely can they be depended upon for effective natural control of major infestations. Nevertheless, they actually do prevent most incipient infestations from becoming serious, as is discovered when applications of DDT have been made to control the aphids.

The DDT is just short of 100% effective in killing the aphids, but it is completely so in killing the parasites and predators of the aphids. Lacking any sort of natural control, the few surviving aphids rapidly increase in numbers, almost equaling the predictions of mathematicians as to their theoretical possibilities. Eventually parasites and predators from adjoining fields, or from the surrounding environment, not all of which has been dusted with DDT, gradually drift in to enjoy an almost unlimited supply of food. As most heavy infestations of *Sipha flava* develop during dry weather, adding the effect of the drought to the feeding of the aphids in stopping the growth of the cane, an extended period of wet weather often proves to be a most effective remedy in control. During such periods of high humidity, the entomogenous fungi, *Acrostalagmus albus* and *A. aphidum*, may destroy every aphid over large areas. Cane growers, impatient in waiting for wet weather, may spray with nicotine sulfate, or dust their cane with cyanogas dust, which gives immediate and almost perfect results directly in proportion to thoroness of application. Since the aphids live on the underside of the leaves, the spray must be directed from below, for it must actually come in contact with the aphids to kill them. Dusting is simpler and more effective, but obviously the dust does not settle up and the great bulk of the application is wasted. When the cane grower guesses right about rainfall, or the effectiveness of natural control in his cane fields, he wins; but if he guesses wrong, the entire planting may be lost due to mass yellow aphid infestation. "The Introduction of Predaceous Beetles into Puerto Rico to aid in the control of the Yellow Aphid, *Sipha flava*" written by Dr. K. A. Bartlett for presentation at the Sixth Congress of International Sugar Cane Technologists, pp. 383–5, at Baton Rouge in 1939, summarizes one other attempt to solve this problem.



Winged female of *Aphis maidis* Fitch. Greatly enlarged. (After Webster.)

Aphis maidis Fitch, the corn leaf aphid, sometimes occurs in large numbers on the husks and tassels of corn. Historically in Puerto Rico, of the greatest importance because of its role in "The Transmission of Sugar-Cane Mosaic by *Aphis maidis* under Field Conditions in Puerto Rico" (Phytopathology, **13** (1): 24–9, fig. 1. January 1923), as shown by the experiments conducted by Carlos E. Chardón and R. A. Veve at Fajardo, its role as vector depends on its presence on weed grasses, such as *Eriochloa subglabra*, in cane fields. Weeding of the grasses causes it to migrate to cane, where it temporarily infests the central shoot. This forced adoption of sugar-cane as a host caused by clean cultivation of the field is an essential factor in the transmission of the disease. Otherwise the aphids would never occur on sugar-cane. Adults soon fly away to more acceptable hosts, but the nymphs continue feeding on the unnatural host of sugar-cane until they also become adult, as was discovered by Mr. Francisco Seín. Sur-

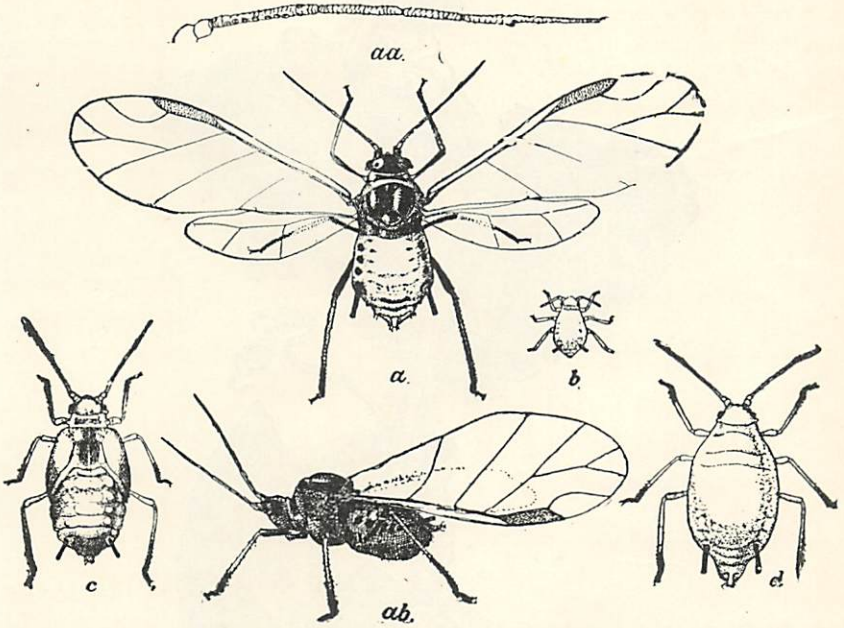


Apterous female of *Aphis maidis* Fitch. Greatly enlarged. (After Webster.)

prisingly enough, these aphids are a preferred food for the little grass lizard, *Anolis pulchellus*, and in the case of seven individual lizards, formed a sixth of the total food. They are also eaten by the crested lizard, *Anolis cristatellus*, but not in such numbers. Possibly this is one reason why one seldom finds many aphids on grass or cane, regardless of their abundance on adjacent corn.

Aphis gossypii Glover is a comparatively minor pest of cotton in Puerto Rico, compared with the injuries it often causes to cucumbers, honey-dew melons, cassava melons and watermelons. Indeed, if these are to produce a crop, it is sometimes necessary to spray repeatedly with nicotine sulfate while the plants are young to give them a chance to grow at all. The aphids cause a tight curling of the leaves while still tender, rendering their control almost impossible unless spraying is started early, before they are protected by the hypertrophy of the plant. The aphids seem to thrive on wind-blown beaches, and under such conditions even continuous spraying seems to have little effect. Repeated plantings of honey-dew melons on the beach

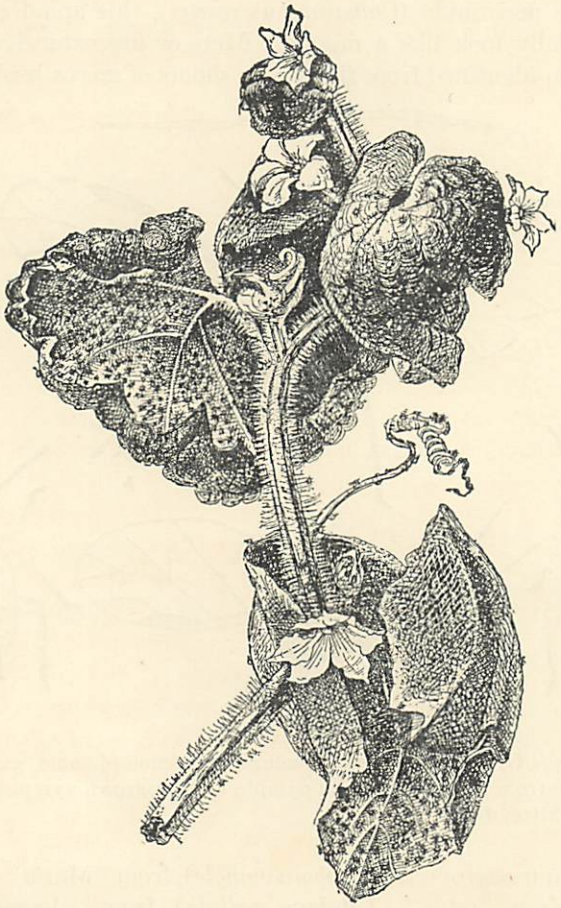
in the Condado were complete failures. An acre of watermelons, planted on Mona Island, produced not a single melon, due to mass infestation by this aphid. Cotton grown close to the ocean at Isabela and Hatillo, just behind the sand dunes, invariably has some aphids on most leaves, but that less exposed to driving winds may be entirely free. On the leaves and flowers of the periwinkle (*Catharanthus roseus*), this aphid causes lesions that superficially look like a mosaic. More or less extensive infestations have also been identified from the tender shoots of guava bushes (*Psidium*



Aphis gossypii Glover: *a.* winged female; *aa.* antenna of same, greatly enlarged; *ab.* dark female from the side; *b.* small nymph; *c.* fully-grown nymph; *d.* wingless female. (After Chittenden.)

guajava), from mangrove (*Rhizophora mangle*), from "María" (*Calophyllum antillanum*), from "roble" (*Tabebuia pallida*), from "almendra" (*Terminalia catappa*), as well as from hibiscus, Pánama potato, tobacco, eggplant and okra. From this long list of possible hosts one should not conclude that most of these plants are often infested, as most of the records refer to only one known occurrence, but in every case, the aphids were definitely identified by Dr. P. W. Mason. Tender leaves of the mango may also be infested, and those of orange at Juana Díaz and of young grapefruit at Añasco are recorded, but these are really exceptional cases. Wet weather sometimes checks incipient outbreaks on melons and cucumbers, for the

aphids are quite susceptible to fungus attack, being hosts for *Cladosporium aphidis* according to Miss Vera K. Charles. They have been found only once in the mountains: on *Cecropia peltata* at Lares. From leaves of *Solanum torvum*, crumpled and distorted by a mosaic, found at Río Piedras



Leaves of melon tightly curled as a result of mass attack by *Aphis gossypii* Glover. (After Chittenden.)

in February 1947, these aphids have been collected, their determination being by Dr. P. W. Mason.

Aphis medicaginis Koch, as identified by Prof. E. O. Essig from material collected at Arecibo, is at times enormously abundant on the underside of the tender leaves of seagrape (*Coccoloba uwifera*). It is however, by no

means so universally present as on the flower stems of "madre de cacao" (*Gliricidia sepium*) each spring, when the blossoms first appear, often causing them to drop without setting seeds. If these host plants were of any particular importance, such universal infestations might seem serious; actually they serve mostly to supply food for a host of Syrphid fly larvae and other predators. This aphid, as identified by Dr. P. W. Mason, has been reported on crotalaria at Mayagüez.

Aphis fabae Scopoli, twice identified under the name *Aphis rumicis* L., on seagrape (*Coccoloba uvifera*) at Ponce, is possibly quite as common on tender leaves as *Aphis medicaginis*, occurring with it, often on the same leaf, but in separate colonies. As the seagrape leaves toughen and harden, the aphids disappear, and neither aphid has been noted on old leaves. The fresh tender leaves of the beach bean (*Canavali maritima*) are also at times heavily infested, and numerous records are of infestations on other leguminous plants, not necessarily on the beach: string beans at Loíza and Manatí, lima beans at Loíza and Vega Baja, and pigeon peas at Río Piedras and Isabela. Mr. H. K. Plank (1943–22) reports heavy infestations on the orange-glow vine (*Senecio confusus*) under the name *Aphis rumicis* L., and it has also been found at Arecibo on *Lantana camara*.

Aphis asclepiadis Fitch, called *Aphis nerii* Fonscolombe in previous records from Puerto Rico, is a large yellow aphid with black antennae and legs, of which infestations often entirely cover the flowering stems and the underside of the more tender leaves of the smaller milkweed (*Asclepias curassavica*) in the more humid parts of Puerto Rico, and of the giant milkweed (*Calotropis procera*) in the dryer regions and on Vieques Island. It is possible that some milkweed plants do occur without these aphids, but they are so universally present that one normally expects to find them on every host. Instances have been noted of such heavy infestations on giant milkweed at Yauco, Ballena and Boquerón that old leaves and mature seedpods were covered with aphids, or their empty skins that had been drained of nourishment by Syrphid fly larvae.

Aphis illinoisensis Shimer, in the earlier Puerto Rican records listed as a *Microsiphum*, or as *Aphis viticola* Thomas, has been found on cultivated grape at Río Piedras, Mayagüez and Ponce, and by Dr. M. D. Leonard on Vieques Island. More rarely, it has been noted on the wild endemic grape or "caro" (*Cissus sicyoides*), not in abundance but with sufficient persistence to serve as a constant source of reinfestation for cultivated grape vines.

The first Puerto Rican record of **Aphis spiraecola** Patch was on grapefruit at Mayagüez, October 23, 1926, when it was intercepted by Mr. S. D. Whitlock. It has since often been noted on grapefruit and especially on wild orange in all the more humid parts of the Island, tightly curling the leaves of watershoots into grotesque rosettes. This early record for Puerto

Rico follows closely on its sudden appearance in Cuba and Florida in 1924 and 1925 as a serious pest in commercial citrus groves, having previously been known only in the northern United States as the green apple aphid.

Aphis spiraecola Patch, as both winged forms and immature stages, was found by Mr. José Adsuar on papaya (*Carica papaya*) in abundance at seven different localities in Puerto Rico in March 1945. Subsequently in the laboratory he was able to prove "The Transmission of Papaya Mosaic by the Green Citrus Aphid, *Aphis spiraecola* Patch" (Technical Paper No. 2, Agr. Expt. Station U. P. R., pp. 5, pl. 1. Río Piedras, June 1946), using these aphids as vectors of the disease. Papaya mosaic is a very different disease from bunchy top, of which Mr. Adsuar found the leafhoppers, *Empoasca papayae* Oman, to be the vector.

Brevicoryne brassicae L., discussed as an *Aphis* as a pest of cabbage by Dr. Richard T. Cotton (1918–283), and **Rhopalosiphum pseudobrassicae** Davis, identified by Dr. P. W. Mason, are found on cabbage, broccoli, mustard and Chinese mustard. The later was noted by Dr. J. A. B. Nolla (1929–66) as host of the entomogenous fungus *Acrostalagmus aphidum*. Both aphids are cosmopolitan species, light green in color, covered with a white bloom. According to Dr. Essig, the latter may be distinguished "by the presence of sensoria on the fourth antennal segment of the winged forms".

Rhopalosiphum subterraneum Mason, as identified by Prof. E. O. Essig, has been found in injurious abundance on the roots of rice at Río Piedras in February 1944, but these purple subterranean aphids had almost disappeared in March, and none was to be found in April.

Rhopalosiphum nymphaeae L., first identified in Puerto Rico by Dr. H. L. Dozier, is a cosmopolitan species occurring on water-lily, and sometimes on other aquatic plants.

Carolinaia cyperi Ainslie, first determined from Puerto Rico by Dr. A. C. Baker, is a greenish-yellow aphid to be found normally only on the underside of the leaves of the common sedge, "coquí" (*Cyperus rotundus*). This sedge, a common weed in cane fields, was present in the field experimental cages used by Chardón and Veve in their transmission experiments of the mosaic disease of sugar-cane, and was therefore included by them (1923–24) as a possible vector of the disease. This aphid, however, does not normally feed on sugar-cane, and Dr. F. M. Wadley (1937–112) thought it of not "much importance in field transmission." Drs. H. Douglas Tate and S. R. Vanderberg subsequently found it to be "as good as *Aphis maidis*" in the "Transmission of Sugarcane Mosaic by Aphids" (Jour. Agr. Research, **59** (1): 73–79. Washington, D. C., July 1, 1939).

Hysteroneura setariae Thomas, as determined by Prof. J. J. Davis, was

called by Mr. Thos. H. Jones (Bulletin No. 11, Insular Experiment Station, pp. 19, pl. 2. San Juan, March 5, 1915) the "brown sugar-cane aphis". It is a purplish-brown species, "not common, occurring in small numbers at the junction of the leaf-sheaths and blades of young cane, covered with sheds of earth built over them by ants, *Solenopsis geminata* Fabr., the 'hormiga brava.'" It has also been noted on the stems, leaves and spike of wire grass (*Eleusine indica*), and Dr. F. M. Wadley (1937–108) records collections on *Gynerium sagittatum* at Guánica, and on *Panicum barbinode* at Rincón, Arecibo and Yabucoa. He found that "the species is much more abundant in dry than in rainy weather", but altho able to transmit the mosaic disease of sugar-cane, of little importance because of scarcity and "at least as numerous in areas of slow spread as in areas of rapid spread."

Toxoptera aurantii Fonscolombe was first reported from Puerto Rico by Mr. R. H. Van Zwaluwenburg (1917–516) as "extremely abundant on new sprouts of coffee, which it occasionally damages severely. Other hosts are orange (which is commonly allowed to grow in a half-wild state amid the coffee) and "geo", an undetermined tree. For two years the writer has witnessed almost complete control of the aphid during the late spring in the mountain plantations by the entomogenous fungus, *Acrostalagmus albus*." In dry weather, when entomogenous fungi are ineffective, these aphids become so abundant as to form an important source of food for the honey creeper or "reinita" (*Coereba portoricensis*). Possibly they are full of honey, for their excretions often attract ants, Dr. M. R. Smith (1937–845 and 954) citing *Crematogaster steinheili* Forel and *Wasmannia auropunctata* Roger, the latter being the infamous "albayalde" of coffee groves. Besides the "geo" mentioned by Van Zwaluwenburg, which presumably is *Ocotea portoricensis*, the tender leaves of numerous other trees are infested: "mantecado" (*Rapanea ferruginea*), "jagua" (*Genipa americana*), cacao and lime in the mountains; and on the coast, seagrape (*Coccoloba uvifera*), "mamey" (*Mammea americana*), "María" (*Calophyllum antillanum*), *Chinchona* spp., mango and grapefruit. It has even been found on the hedge of the post office building in San Juan, when the plant quarantine inspectors had their headquarters there, and eventually managed to intercept from these bushes of "café de la India" (*Murraea* or *Chalcas exotica*) many more insects than casual inspection would indicate could possibly live on them. The tender leaves of grapefruit, orange and mamey are somewhat curled and distorted by the feeding of this aphid, the mamey most of all if infestation occurs when it is less than an inch long. In a colony covering an entire mature and undistorted grapefruit leaf, every aphid had been parasitized by *Aphidius testaceipes* Cresson, but such instances of total parasitism are by no means common.

Curling of the leaves of grapefruit caused by infestation by *Toxoptera aurantii* Fonscolombe, the aphids on the lower leaf being parasitized by *Aphidius testaceipes* Cresson. (Drawn by Francisco Sefn.)

Amphorophora sonchi Oestlund, first identified from Puerto Rico as *Amphorophora lactucae* Kaltenbach by Dr. A. C. Baker from wild lettuce at Adjuntas, also occurs on cultivated lettuce, and is reported by Mr. H. K. Plank (1943–22) on the orange-glow vine, *Senecio confusus* Britton.

Macrosiphum ambrosiae Thomas, as determined by Dr. P. W. Mason, has been found on lettuce at Villalba, and on the branches and leaves of the straw flower (*Helichrysum bracteatum*) there and at Indiera, but it also

occurs close to sea level, for it has been found on gandul pods at Río Piedras, and on "salvia" (*Pluchea purpurascens*) at San Juan and on Mona Island.

Macrosiphum erigeronensis Thomas has been found on dahlia at Guaynabo, and on *Erigeron canadensis* at Dorado, as determined by Dr. P. W. Mason.

Macrosiphum luteum (Buckton), as identified by Miss Louise M. Russell, was found on Cattleya and other cultivated orchids at one point in Pueblo Viejo by Mr. Ferdinand Méndez in November 1949. Originally described from orchids in a greenhouse at Carshalton, Surrey, England, it has since been found in India, and is common in Mexico, Central and South America. In late 1948 this aphid was discovered in Hawaii. It is a large yellow species with black legs, and the apterous form when fully mature typically has a dark dorsal spot. No winged forms have been noted in Puerto Rico, and, so far as known, the aphid has not spread from the locality of original discovery. The outbreak has been controlled with a thoro application of DDT and nicotine sulfate, and as no recent infestations have been observed, it is hoped that the species has been eradicated.

Macrosiphum rudebeckiae Fitch, as determined by Dr. Mason, has been found infesting Ghillardia at Guaynabo.

Macrosiphum solanifolii Ashmead on cultivated peas at Cidra was identified by Dr. P. W. Mason. Lima beans serve as host for **Trifidaphis phaseoli** Passerini at Cidra, for a black-veined aphid, **Picturaphis vignaphilus** Blanchard, and for **Megoura vicae** Buckton, all identified by Dr. P. W. Mason. He considers the aphids from *Dendrobium moschatum* to be a new species of **Megoura,** and has identified those from mint as being **Phorodon menthae** Buckton.

Myzus circumflexus (Buckton) has been collected by Messrs. H. K. Plank and H. F. Winters on *Chinchona* sp. in the mountains back of Mayagüez.

Myzus persicae Sulzer, first reported as a *Rhopalosiphum* from Puerto Rico by Dr. Richard T. Cotton (1918–296) as a serious pest of eggplant and peppers, has also been found on Irish potato, tomato and turnip. Altho killed during wet weather by entomogenous fungi, of which Miss Vera K. Charles lists *Empusa fresenii*, *Cladosporium aphidis* and *Acrostalagmus albus*, during dry weather this aphid may become very abundant in fields of eggplant and pepper being grown for the continental market and prove difficult to control. At Isabela, where these vegetables are grown under irrigation during the sometimes rainless winters, and no aid from entomogenous fungi can be expected, the problem of control is serious, for the parasites and predators so common on other aphids, appear to avoid this

species. In their "Studies on the Mosaic of Peppers (*Capsicum frutescens*) in Puerto Rico" (Jour. Agr. U. P. R., **25** (4): 40–50, fig. 4, ref. 7. Río Piedras, April 7, 1942), Messrs Arturo Roque and José Adsuar state that "evidence of transmission of mosaic by the aphids, *Myzus persicae*, has been obtained". One of the most surprising host relationships of this aphid is of occurrence in large numbers on the green fruits of papaya in 1938 at Isabela, before mosaic disease of this plant had been observed in Puerto Rico. Identification of the material was by Dr. P. W. Mason, as was also that of aphids collected from mosaic plants of "escoba" (*Sida carpinifolia*) at Ponce by Mr. José Adsuar in February 1947. No connection between the mosaics of the various hosts of this aphid has yet been determined.

Pentalonia nigronervosa Cockerell has a very accurately descriptive name by which one will at once recognize this aphid pest of such succulent plants as the banana, yautía, malanga, water-lily and cultivated calla. It may occur in considerable abundance, but hardly in such numbers as to be considered even a minor pest economically. Dr. M. R. Smith (1937–845, 854, 866) notes that it is attended by the ants *Pheidole s. borinquenensis* Wheeler, *Wasmannia auropunctata* Roger and *Brachymyrmex heeri* Forel.

Xenopterygus ipomoiae was described by Mr. Clyde F. Smith as "A New Aphid on Sweet Potato" (Florida Entomologist, **31** (1): 24–26, fig. 1. Gainesville, March 1948), from roots of "*Ipomoia batatas*" (ordinarily written *Ipomoea Batatas* (L.) Lam.), collected by Mr. W. D. Wylie at Clewiston, Florida; others from leaf of dasheen or "yautía malanga" (*Caladium Colocasia* (L.) W. F. Wight), intercepted by Messrs. Richard Faxon, C. G. Anderson and A. S. Mills, December 19, 1932 at Guaynabo, Puerto Rico.

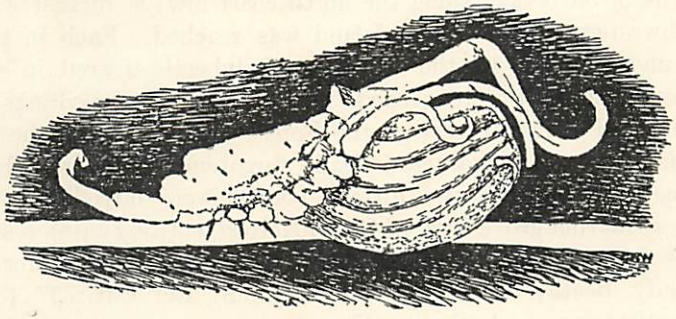
Cerataphis lataniae Boisduval is at once differentiated from any other aphid present in Puerto Rico by the broad white waxy halo which surrounds their round black bodies. The plant quarantine inspectors have repeatedly intercepted this pest on orchids from Venezuela, but it is unquestionably firmly established in Puerto Rico on cultivated vanilla, on various ornamental palms, and especially on the dwarf coconut palms imported from Malaya. Dr. P. W. Mason has identified as a species of **Aleurodaphis** material collected on coconut palm at Mayagüez.

Coccidae: Scale Insects & Mealybugs

Up to the end of the last century, only a single kind of scale insect (Coccidae) was known to exist in Puerto Rico. When the U. S. S. "Fish Hawk" was sent to the Island in January–February 1899, the representative of the Division of Entomology on board, Mr. August Busck, had been instructed to make a special point of collecting scale insects. The "List of the Coccidae collected by Mr. A. Busck in Porto Rico" by T. Pergande

and T. D. A. Cockerell (Bulletin No. 22, n.s., pp. 88–93, Division of Entomology, U. S. Dept. Agr., Washington, D. C., 1900) shows that even at that early period, most of the species now common were already present.

What has fancifully been called the wedding cake scale, **Icerya montserratensis** Riley & Howard (Monophlebinae), was collected by Mr. Busck at that time, on orange at Mayaguez and Bayamón. It has since been found on many other kinds of trees, such as grapefruit, the coffee shade trees (*Inga vera* and *Inga laurina*), "mamey" (*Mammea americana*), guava (*Psidium guajava*), "María" (*Calophyllum antillanum*), "caimito" (*Chrysophyllum argenteum*) and coconut. Possibly the most extensive infestations on record were those on the "laurel de la India" (*Ficus nitida*), growing in the plaza de recreo of Manatí and Caguas. That at Caguas in 1932 was especially severe, most the trees losing their leaves, so that for a time it



Icerya montserratensis Riley & Howard. Five times natural size. (Drawn by G. N. Wolcott.)

seemed doubtful if they would survive. This scale is parasitized by a small yellow Ichneumonid wasp, *Rhyssalus brunneiventris* Ashmead. It really is quite a large wasp, considering that it parasitizes only a scale insect, and that the larva must obtain all its nourishment for complete development to adult from a single scale. The wasp is normally so effective in control that it entirely eliminates most outbreaks at their inception, and all of them eventually, and then most of the wasps perish because they can find no more scales to parasitize.

Icerya purchasi Maskell, the Australian cottony cushion scale, was first noted in Puerto Rico by Dr. W. A. Hoffman (Jour. Ec. Ent., **25** (3): 726. Geneva, June 1932) on trees of beefwood or Australian pine (*Casuarina equisetifolia*) in the patio of the School of Tropical Medicine at Puerta de Tierra, and in hedges in the Condado and Miramar sections of Santurce. Dispersing across San Juan harbor, it became threateningly abundant in Isabela grove and adjoining grapefruit at Palo Seco, but was gradually

brought under commercial control there by means of the introduced Australian ladybeetle, *Rodolia cardinalis* Mulsant, plus various native predators and parasites, some of which, previous to its occurrence in Puerto Rico, are presumed to have fed upon *Icerya montserratensis*. Perfect control was obtained in the citrus groves of the more sheltered Pueblo Viejo district during the hot, rainy summer of 1933 by an entomogenous fungus identified by Miss Vera K. Charles as *Spicaria javanica* Bally. It is so completely effective under suitable conditions of humidity and protection from rapid evaporation of moisture that its total failure to develop close to windswept beaches, as at Dorado and on Mona Island, is all the more noticeable. "The Dispersion of the Cottony Cushion Scale in Puerto Rico in Eight Years" (Caribbean Forester, **2** (3): 132–5, map. New Orleans, April 1941) in the direction of prevailing winds, is shown by the records of outbreaks along the north coast always further west until the northwestern corner of the Island was reached. Each in turn was brought under control by the introduced ladybeetle, reared in captivity and released when and where needed. Infested beefwood seedlings brought from the Río Piedras nursery of the Forest Service carried the scale to Mona Island, where it characteristically threatened to destroy the plantings of casuarinas, until the *Rodolia* beetles were introduced. In the extensive casuarina grove back of Camp Kofresí, cottony cushion scale still continues to exist in varying abundance, forming a reservoir for "Introduced Lady Beetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, 1944) to supply Puerto Rico, if necessary.

The cottony cushion scale does continue to exist in Puerto Rico, but all the various factors of natural control combine to prevent even the most minor of outbreaks, except under exceptional conditions. The most recent ones were of single wild orange trees at Loíza Aldea (1944) and in limes at Palo Seco (1945) and grapefruit at Bayamón (1947): very minor by comparison with those just after its accidental introduction. Sometimes one sees a few scattered individuals on beefwood, and even on rose bushes, but nothing comparable to the mass infestation on these preferred hosts ten years previously. At that time it was also found on "gallego" (*Polysias guilfoylei*), on "Don Tomás" (*Adenoropium multifidum*), on "bayahonda" (*Prosopis juliflora*), on "bucare" (*Erythrina glauca*), on "María" (*Calophyllum antillanum*), on "capa del obispo" (*Acalypha wilkesiana*), on hibiscus, on pigeon pea, on "boisenberry" (a cultivated raspberry) at Isabela and on various other citrus trees besides grapefruit and orange, such as lime and rough lemon.

The dense waxy secretions which make the "cushion" or egg-sac of *Icerya purchasi*, or the ribbons, like those made by a cake-decorator, of

Icerya montserratensis, merely serve to outline the segmentation of the intensely pink bodies of **Crypticerya rosae** (Riley & Howard). First noted on "cambrón" (*Casearia aculeata*) at Ponce, it is quite common on the beefwood trees (*Casuarina equisetifolia*) at El Vigía there, and at Guánica both on the twigs, stem and roots of this host. In the Guánica region, it has been noted on lignum-vitae (*Guaiacum officinale*), and on logwood (*Haematoxylon campechianum*), and Prof. J. A. Ramos found it at Mayagüez on "cereza colorada" (*Malpighia punicifolia*). Almost invariably these mealybug-like scale insects are attended by ants, either the "hormiga brava" (*Solenopsis geminata*), or by the ant more characteristic of this xerophytic region: *Crematogaster steinheili* Forel.

Dr. Alex. Wetmore found in the stomach contents of the ground dove, the ani and the mozambique irregular golden lumps, almost as bright as real gold, but softer and scaling: the protective covering of peculiar scale insects (Margarodinae) called "ground pearls", **Margarodes formicarium** Guilding, which live in the ground, attaching themselves to the roots of plants. Nobody knows just how abundant they really are, for the damage caused to the aerial portions of the host is inappreciable. In sandy land, they may prove a rewarding search for buried treasure, for in three square feet of pasture at Pt. Cangrejos, three ground pearls were found. The iguanas (*Ameiva exsul*) living on the beach, which burrow into the sand for food, and for shelter at night, recognize them as digestible food items, or at least they actually do eat them.

The fleshy stems of the variegated-leaved coleus so extensively planted along roadsides in Puerto Rico when Governor Winship was here, during dry weather are subject to mass infestations of **Orthezia insignis** Browne (Ortheziinae), that sometimes entirely defoliate the plants, and may kill them back to the ground. The insects themselves are black, with exceptionally long and prominent legs (for scale insects), by means of which even the adult females are able to move about slowly. The production of a white waxy secretion begins with the immature stages, and for the adult female results in an elongate quadrangular mass, quite obscuring her black body underneath. Coleus is not the only ornamental infested, for occurrence on rose, rose geranium, begonia and chrysanthemum has been observed, and extensive infestations may develop on the recumbent *Chenopodium ambrosoides*, or on *Lantana camara* or *Eupatorium odoratum*, or similar weeds of the beach or roadside.

When most intensive observations were being made on the insects coming to the flowers of "botoncil'o" (*Borreria verticillata*), infestation by this scale was not noted, but twenty years earlier at Pt. Cangrejos, 59 individual scales had been found on a few scattering plants, at that time known under

the name *Mitracarpus* (*Spermacoce*) *portoricensis*, growing in three square feet of sandy pasture. Considering how many alternate hosts exist in Puerto Rico, it is hardly surprising that Governor Winship's project of hiding the tiresome cane fields behind hedges of coleus should have failed so miserably, mostly because of this one scale insect.

Orthezia praelonga Douglas, as identified by Dr. Harold Morrison, has light green or whitish legs and body. In recent years it has become increasingly abundant, on the underside of the leaves of such ornamentals as crotons and "capa del obispo" (*Acalypha wilkesiana*), and bougainvilleas, most often when these plants are planted too close to the house and do not receive the normal amount of rainfall that might help to wash off or beat off scales on plants out in the open. Possibly this is a rather recently introduced insect, for all records except one, on casuarina at Ponce, are from the San Juan region. At Río Piedras, an introduced ladybeetle, *Cladis nitidula* F., has repeatedly been found feeding on these scales. This is a bright yellow beetle, with iridescent green elytra and head, its larvae being white, yellow and black, which seems to specialize in its food habits, if possible confining its attack to these scales, and soon eliminating considerable infestations.

Conchaspis angraeci Cockerell, reported by Mr. R. H. Van Zwaluwenburg (1917–34) as a pest of vanilla at Mayagüez, "not likely to become important" had earlier been found in Puerto Rico on croton at Mameyes and since only on an unidentified tree at Río Piedras.

Dr. Harold Morrison, responsible for almost all recent identifications of scale insect material from Puerto Rico, considers the brown soft scale heavily infesting a coffee shade tree, *Inga vera*, at Maunabo to be a new species of **Lecaniodiaspis.** Despite the abundance of this scale on the trunk and branches of a single tree at the time of collection, December 1937, it was heavily parasited, and has not since been found elsewhere.

The coffee shade tree *Inga vera* is also host of another scale, **Asterolecanium ingae,** described by Miss Louise M. Russell in "A Classification of the Scale Insect Genus *Asterolecanium*" (Misc. Pub. No. 424, pp. 322, many illus. ref. 100. Washington, D. C., November 1941) on page 111, from an abundance of material collected at Utuado by Mr. Vicente Medina.

Mr. Aug. Busck collected what was at that time identified and reported as *Asterolecanium aureum* (Boisduval), now called **A. epidendri** (Bouché), "on leaves of a fiber plant, at San Juan", but nobody has found it since.

The really common species of this genus occur on bamboo: **Asterolecanium bambusae** (Boisduval), **A. militaris** Boisduval var. **robustum** Green, and **A. longum** (Green) (= *A. lanceolatum* Green), the two latter mostly on its leaves, the first on the trunk, all most abundant on *Bambusa*

vulgaris, but also present to some extent on other kinds of bamboo. In an effort to reduce the numbers of these scales, and possibly popularize the use of bamboo in Puerto Rico, Mr. Atherton Lee, while Director of the Federal Experiment Station at Mayagüez, was most active in the importation of ladybeetles to feed upon them. Most of the imported ladybeetles perversely preferred to feed on other kinds of scale insects, and many Puerto Rican peons perversely think that the use of bamboo stamps them as being orientals. Just before election time, when everybody wants to fly his party flag, especially in Cataño, the very tallest and straightest of bamboo poles are at a premium, but until recently this seemed to be the only use of bamboo in Puerto Rico. *Bambusa vulgaris* was at one time extensively planted as windbreaks for citrus groves along the north coast, but most of these have been dug up since the decline of the grapefruit industry, and those remaining have no apparent economic function. *Bambusa tulda* and *Bambusa tuldoides*, but little infested with scale insects when alive, or by powder post beetles when harvested and cured, are increasingly being planted around Mayagüez and Ponce for the manufacture of furniture and fishing-rods.

Asterolecanium pustulans (Cockerell), commonly called the pustule scale because of the hypertrophied plant tissue which grows up like a volcanic crater, or pustule, around it, is a very serious pest on a few preferred hosts. Indeed, to it may be ascribed the practical disappearance of the Australian silver oak (*Grevillea robusta*), after it had been introduced and extensively planted, some twenty years ago. Another imported tree, *Sciacassia siamea*, more especially recommended by the Forest Service because of its rapid growth, is very susceptible to attack by the pustule scale. Even its main trunk, six or eight inches in diameter, may be killed, but fresh watershoots come out from below, perpetuating the tree in a much distorted form to serve as continuous host for the scale. The valuable endemic "maga" (*Montezuma speciosissima*) often has all the leaves of its lateral branches killed by this scale, the injury at a distance looking like fire-blight of pear in the way the dead brown leaves cling to the dead twigs. "Mangle botón" (*Conocarpus erecta*) and Humboldt's willow (*Salix chilensis*) are sometimes heavily infested, but the maximum lesions in depth of pustule and the eruption of a crater around the scale at the bottom of the pit, are on oleander (*Nerium oleander*), especially on young twigs and leaves. Even the fruiting pods of "cañafístula" (*Cassia fistula*) show the deep pits, and the petioles of the leaves of balsa or "guano" (*Ochroma lagopus*). These are the most seriously injured trees; the complete list of all those ever infested in Puerto Rico is long; on Vieques Island, trees of níspero (*Achras zapota*) were killed. Yet despite the seriousness of the

injury which the pustule scale may cause for a time, even the most severe infestations eventually disappear. Except for roughened areas of pits no longer inhabited by scales, no trace of former heavy infestation remains. Such complete elimination of the scale is apparently due to specific parasites, of which Dr. H. L. Dozier has reared and described *Mercetiella reticulata* and *Euaphycus portoricensis*. When infestations are at their peak of intensity, some scales will show the exit holes of these parasites. Later, most of the scales will give this indication of having been killed, and eventually, every scale will be destroyed by the parasites, the perfection of control locally being so complete that no scales are to be found for a number of years on any of the preferred hosts. These two parasites were reared only from the pustule scale, and presumably are endemic in Puerto Rico. The first record of *Asterolecanium pustulans* in Puerto Rico is of collection by Mr. August Busck (1900–92) on *Annona muricata* at San Juan, altho the type was described from Jamaica, on oleander in 1892. Altho now of cosmopolitan distribution in the tropics, it may be endemic in the West Indies and the original, normal and only host of these parasites, which, to date, are known only from Puerto Rico.

Pseudococcus brevipes (Cockerell), a mealybug (Pseudococcinae), is the only obvious major pest of pineapples in Puerto Rico. It is especially abundant in the pineapple fields of the Lajas region, possibly because of the non-commercial varieties grown there, and was enormously abundant on the first Smooth Cayenne planted on Vieques. It is a cosmopolitan pest which may be destructive in any part of the Island but normally is of little importance in the more humid areas. One of the earliest aids to the inexperienced pineapple grower made by the Mayagüez Station was Mr. W. V. Tower's recommendation on the "Control of the Brown Ant (*Solenopsis geminata* Fabr.) and the Mealy Bug (*Pseudococcus citri* Risso) in Pineapple Plantations" (Circ. No. 7, pp. 3. Mayagüez, 1908), by means of spraying with an emulsion of crude carbolic acid, or "cresol" as it is called locally. Until very recently, this was still the most practical method of control of both ants and mealybugs, altho the quality of cresol now available is hardly comparable in efficiency to that when its use was first advocated. Dustin wgith DDT is now being practised. The spraying experiments conducted by Mr. Mario Pérez for the control of "gumosis" indicate most complete elimination of mealybugs when the developing fruits are sprayed at two week intervals with chlordan. In the Lajas region expecially, the use of insecticides is less often necessary because of the establishment of introduced parasites of the mealybug: *Hambletonia pseudococcina* Compere and *Anagrus coccidivorus* Dozier. The sweet syrupy exudations of the mealybug prove attractive to many other kinds of ants than

the "hormiga brava", but this one most often attends it in the open in pineapple plantations. Dr. M. R. Smith, junior author with Mr. H. K. Plank of "A Survey of the Pineapple Mealybug in Puerto Rico and Preliminary Studies of its Control" (Jour. Agr. U. P. R., **24** (2): 49–76, fig. 6, ref. 11. Río Piedras, August 1940) lists fifteen others. On the aerial roots of a "jagüey" (*Ficus laevigata*) at Manatí, this mealybug determined by Prof. G. F. Ferris as *Pseudococcus bromeliae* Bouché, has been observed attended by the hormiguilla. Altho primarily a pest on pineapple, and most abundant on this host normally, this mealybug has also been collected on pomegranate and tamarind, as determined by Dr. Harold Morrison, and, as determined by Prof. Ferris, on the roots of sugarcane at Guánica, and on the roots of the sedge "coquí" (*Cyperus rotundus*) at Guánica.

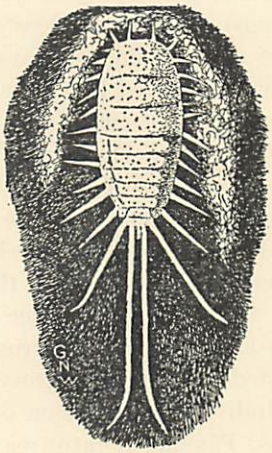
Pseudococcus maritimus (Ehrhorn) has twice been intercepted on pineapple, and once each on tamarind and chayote (*Sechium edule*).

Pseudococcus citri (Risso) quite often does occur on citrus trees in Puerto Rico, but is not of primary importance on this host. From this mealybug Dr. H. L. Dozier has reared four parasitic wasps: *Acerophagus nubilipennis* Dozier, *Leptomastix dactylopii* Howard, *Thysanus nigrus* Ashmead and *Thysanus bifasciatus* Ashmead. Where these wasps can not penetrate, as on the roots of coffee seedlings, it may become a real pest, but as coffee seedlings are handled in practise in transplantation, few mealybugs can survive. It is attended by the hormiguilla on coffee, on both the aerial and subterranean portions of the host, and also in the hormiguilla tunnels. Mr. O. W. Barrett, under the name of *Dactylopius citri*, (1903–445) first noted it as a pest of citrus stock, and considerable infestations have been noted in grapefruit groves at Palo Seco (Isabela Grove) and at Isabela. Individual records on other hosts are on celery, gandul, the roots of a grass, Pánama potato tree at Juncos, on "higuillo" (*Piper adunctum*), guava (*Psidium guajava*) and on "maga" (*Montezuma speciosissima*).

After one kind of yellow mealybug had been found repeatedly in the stomachs of the grass lizard, *Anolis pulchellus*, specimens were sent to Prof. G. F. Ferris, who identified them as **Pseudococcus comstocki** (Kuwana), the only record for the Island.

Pseudococcus adonidum (L.), first recorded by Mr. R. H. Van Zwaluwenburg from Puerto Rico under the name *Pseudococcus longispinus* Targioni as a minor pest of coffee, is most readily observed on the underside of the broad leaves of "almendrota" (*Barringtonia speciosa*), where it seems to be almost invariably present. It has not been observed on this host on Mona Island, however, nor is it known from any other host there. In Puerto Rico it occurs on many other plants. On some elephant ears or "yautía"

(*Xanthosoma* sp.) growing under the eaves of a house in Río Piedras and thus protected from rainfall, it became so abundant as to entirely cover the host, and overflowed on to everything in the neighborhood. On dracaenas and jasmin vines growing too close up under the eaves and protected from rainfall it may also become very abundant. Out in the open, it is a minor pest on grapefruit and hibiscus, and occurs on such trees as "bucare" (*Erythrina glauca*), "María" (*Calophyllum antillanum*) and "emajagua" (*Pariti tiliaceum*), and on the red amaryllis (*Hippeastrum puniceum*). In the summer of 1946 it was first noted on the leaves of the African cloth-bark tree (*Ficus nekbuda*) in Muñoz Rivera Park and around the Capitol building, on which host it eventually became so abundant that by the spring of 1948, large numbers of imported ladybeetles, *Cryptolæmus montrouzieri* Mulsant, were able to develop, feeding exclusively on the



Pseudococcus adonidum (Linnaeus), eight times natural size. (Drawn by G. N. Wolcott.)

mealybugs. The larvae of these ladybeetles are covered with a white waxy secretion, quite similar in general appearance to that of the mealybugs, but when the fully-grown, very active ladybeetle larvae searching for suitable places for pupation can hardly be mistaken for the quiescent mealybugs. From this mealybug Dr. H. L. Dozier reared the wasp parasite which he named *Acerophagus nubilipennis*.

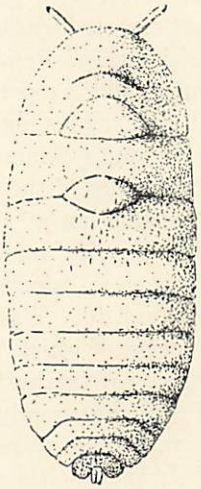
Pseudococcus crotonis (Green) was reported, possibly erroneously, by Mr. E. R. Sasscer ("Important Foreign Insect Pests Collected on Imported Nursery Stock in 1919", Jour. Ec. Ent., **13** (2): pp. 181–4. Concord, April 1920) as intercepted on orchid from Puerto Rico, as it has not since been found here.

Pseudococcus nipae (Maskell) is possibly the most common mealybug

in Puerto Rico. Hardly a guava (*Psidium guajava*) bush on the Island that does not have a few of these mealybugs on its leaves, and often they have heavy infestations attended by "hormiga brava". Mass infestations entirely covering small avocado trees have been noted, and often a few occur on the leaves of such fruit trees as guanábana, coconut, mamey and seagrape. Dr. Luis F. Martorell, when collecting data for his studies on insects of forest trees, found at least a few of these mealybugs on over twenty forest trees, well indicating their lack of pronounced preference for any particular host. The adult female is unmistakable: broad, pink body, with sharply-defined, creamy masses of wax pyramiding from each dorsal division of the body, forming a distinctive shield. During wet weather, it is attacked by entomogenous fungi: *Cephalosporium lecanii*, *Empusa fresenii* and *Botrytis rileyi*, first reported by Dr. Johnston (1915–19 and 21) from Río Piedras. A parasitic wasp, *Pseudaphycus utilis* Timberlake, has been imported for its control, and is reported by Dr. K. A. Bartlett to have become established in the Mayagüez region.

Two kinds of mealybugs are quite common on sugar-cane. **Pseudococcus boninsis** (Kuwana), the bodies of the females of which are grey in color, was referred to under a name not at all suggestive of its economic host, before the studies by Dr. Harold Morrison on the "Identity of the Mealybug Described as *Dactylopius calceolariae* Maskell" (Jour. Agr. Research, **31** (5): 485–500, fig. 6, ref. 16. Washington, D. C., September 1, 1925). The more common species, of which the bodies of the females are pink, is **Trionymus** (or *Pseudococcus*) **sacchari** (Cockerell). For the most part, they live on the stalk of the cane, usually at the nodes under the leafsheaths, and it is in part to expose them to readier destruction by natural enemies that the trashing of sugar-cane has at times been recommended. One often finds leafsheaths gnawed away at the nodes, presumably that the mealybugs concealed beneath may be eaten by the animal doing the gnawing. The leafsheaths are thus not only a poor protection for the mealybugs, but are a distinct liability to them during wet weather, when their sweet, watery secretions do not evaporate, but form a suitable medium for the growth of a fungus, *Aspergillus flavus*. This often attacks the mealybugs as well, killing them with an invading growth of mycelium, and soon covering the whole colony with a layer of greenish-yellow spores. The pink mealybug is host to a Cecidomyid fly, *Karschomyia cocci* Felt, and to an introduced Encyrtid wasp, *Pseudaphycus mundus* Gahan, brought from Louisiana in grey mealybugs supposed to be parasitized by *Aphycus terryi* Fullaway, the involved story of which is related by Mr. A. B. Gahan in describing "Eight New Species of Chalcid-Flies of the Genus *Pseudaphycus* Clausen, with a Key to the Species" (Proc. U. S. National Museum, **96** (3200): 311–27. Washington, D. C., 1946). These minute

flies and wasps may be effective enemies of the sugar-cane mealybug, but are not so obvious as the ladybeetles, of which two kinds have been brought into Puerto Rico for their control. *Cryptolaemus montrouzieri* Mulsant will feed on sugar-cane mealybugs in captivity, but is accustomed normally to attack mealybugs not protected as are these, by sugar-cane-leafsheaths, and promptly reverts to unprotected hosts when released in the field. *Hyperaspis trilineata* Mulsant feeds exclusively on sugar-cane mealybugs, and its normal habitat is under leafsheaths, but repeated introductions sent from Barbados by Mr. R. W. E. Tucker have failed (apparently) to establish it in Puerto Rico.



Trionymus sacchari (Cockerell), partly grown female. Twenty times natural size. (Drawn by G. N. Wolcott.)

The grapefruit grove at the Isabela Substation in 1933 became heavily infested with a mealybug secreting a yellowish wax which proved to be **Pseudococcus (Ferrisia) virgatus** (Cockerell), as determined by Dr. Harold Morrison. This is the only record of this mealybug on grapefruit in Puerto Rico, and its occurrence may in part be due to previous spraying of this grove with Bordeaux mixture. At the same time, a heavy infestation by this mealybug was noted in Santurce, on "grocella" or "cereza amarilla" (*Phyllanthus* or *Cicca disticha*). Many of these mealybugs were parasitized by minute yellow wasps with green eyes, identified at the time by Mr. A. B. Gahan as a *Pseudaphycus*. Other trees are infested, as "almendra" (*Terminalia catappa*), "quenepa" (*Melicocca bijuga*) and ornamental croton, the weed "rabo de gato" (*Achyranthes indica*) and lima beans, cotton and okra.

Geococcus coffeae Green, collected by Mr. Francisco Seín, from near roots of ornamental canna at Río Piedras, is reported by Mr. Edson J. Hambleton in his "Studies of Hypogeic Mealybugs" (Rev. de Entomologia, 17 (1–2): 1–77, pl. 7. Rio de Janeiro, August 1946).

Phenacoccus gossypii Townsend & Cockerell, found on cotton at Humacao by Mr. August Busck in 1899, was a new record for the West Indies, and indeed it has been found on this host in Puerto Rico only once since, at Maunabo in 1922, as determined by Prof. G. F. Ferris. A later host record is on "malva" (*Malachra capitata*), but others are of plants botanically quite unrelated, such as tomato and gandul, the ornamental *Acalypha wilkesiana*, on "artemisa" (*Ambrosia peruviana*) and at Faro de Cabo Rojo, "malvavisco" (*Corchorus hirsutus*).

Puto barberi (Cockerell) was identified by Dr. Harold Morrison from material found on an unidentified tree in the Guánica Forest.

Antonina (Chaetococcus) bambusae (Maskell) occurs under the leaf-sheaths of the bamboos growing at Mayagüez.

The body of the female of the soft, greenish-brown scale, **Pulvinaria psidii** Maskell (Coccinae) is pushed off its host by the accumulation of eggs under its body, and the flocculent waxy secretions surrounding the eggs coalesce and completely cover trees heavily infested. Such used to be the condition of "bucares" (*Erythrina glauca*) nearly every dry autumn, the mass infestations of the scales causing an early shedding of the leaves, after which festoons of waxy threads hung from every twig and branch. No such mass infestations are now to be seen. Those reported from Mayagüez by Mr. W. V. Tower (1908–38) on orange and coffee, by Dr. C. W. Hooker on caimito (*Chrysophyllum cainito*), and in Van Zwaluwenburg's list, on orange, mango and zapote (*Achras zapota*), can no longer be duplicated. The present scarcity of this scale on "bucare", and on its other less usual hosts, such as "muñeca" (*Rauwolfia nitida*), "jagüey" (*Ficus laevigata*), "higuillo" (*Ficus sintenisii*), "cedro" (*Cedrela odorata*), "ausubo" (*Manilkara nitida*), crape myrtle (*Lagerstroemia indica*), "péndula" (*Cithrarexylum fruticosum*), "palo de cabrilla" (*Trema lamarckiana*), and guava (*Psidium guajava*), is due almost entirely to the introduction of an Australian ladybeetle, *Cryptolaemus montrouzieri* Mulsant, brought into Puerto Rico for the control of mealybugs of sugar-cane. These ladybeetles had established an enviable record in California, feeding on exposed mealybugs, where they were called "mealybug destroyers". In captivity in Puerto Rico they fed upon the sugar-cane mealybugs provided, but when released in cane fields, they promptly flew out in search for mealybugs or soft scale insects that were more readily available than those under cane leafsheaths.

Never again did they return to cane fields, except when "An Outbreak of the Red-Striped Scale", **Pulvinaria iceryi** *Cryptolaemus* (Guérin-Méneville) (=*P. elongata* Newstead), in cane fields near Arecibo, as reported

by Dr. H. L. Dozier (Jour. Dept. Agr. P. R., 9 (4): 357–68, fig. 4. San Juan, October 1925), for once furnished an abundance of preferred food. Subsequent records of this scale are on sugar-cane in greenhouses or in screened cages, where they are protected from attack by parasites and predators.

Pulvinaria urbicola Cockerell, as identified by Dr. Harold Morrison, looks like pinkish lumps on sweet potato tubers, but is greenish-brown on seagrape (*Coccoloba uvifera*), and on "bretaña" (*Basella alba*).

Protopulvinaria longivalvata Green, as identified by Dr. Harold Morrison, is a soft brown scale found on the leaves of gardenia (*Gardenia jasminoides*) at Río Piedras in May 1945. Apparently it is eaten by an introduced ladybeetle from Trinidad, *Cladis nitidula* F., for a few months later, none was to be found on the previously infested bushes. It has since been found on the leaves of *Psidium guajava* at Isabela.

The ant known to coffee growers as "hormiguilla", *Myrmelachista ramulorum* Wheeler, in its tunnels in coffee and coffee shade trees cares for and collects the sweetish excretions from the common mealybug *Pseudococcus citri* (Risso), but in addition it has a specific symbiotic shapeless pink scale insect. For many years after its discovery by Mr. W. V. Tower (1911–32), mention by Dr. C. W. Hooker (1913–35) and more extended discussion by Mr. R. H. Van Zwaluwenburg (1917–515), it remained unnamed. Prof. G. F. Ferris described it under the name of *Cryptostigma ingae*, the type from *Inga laurina* at Lares (Canadian Entomologist, **44** (7): 160–1, fig. 4. Orilla, July 1922), and Dr. Harold Morrison described it under the name *Akermes secretus*, the type from *Inga laurina* at Mayagüez (Psyche, **29** (4): 145–8, fig. 20–31. Cambridge, August 1922), the actual date of publication of Dr. Morrison's name antedating that of Prof. Ferris' by a few days. The correct name for this distended, pink "cow" of the hormiguilla should be **Cryptostigma secretus** (Morrison). So far as known, it occurs only in Puerto Rico, but invariably associated with the hormiguilla, not only in its tunnels in coffee and coffee shade trees, but also in its tunnels in "jagüey" (*Ficus laevigata*) at Manatí, and in "pomarrosa" (*Eugenia jambos*) at Adjuntas. The mealybug found with the hormiguilla in cavities in twigs eaten out of solitary trees of "tortugo amarillo" (*Sideroxylon foetidissimum*) at Isabela was determined by Dr. Morrison as being "a species of *Pseudococcus*, but I have not succeeded in placing this as any described species." Of these three symbiots, apparently *Cryptostigma secretus* is the more efficient from the standpoint of the ants, or at least none of its energy is diverted to the production of wax, for it is entirely naked: merely and solely a digestive machine for extracting sap from the host and passing it on to the ants on demand, but also absolutely dependent on them for protection and care.

The wax, closely compressed, and typically molded into an opaque, amorphous shield, but sometimes divided into distinct, sharply segregated plates, is all that one sees from above of the wax scales. On Mona Island, an especially large *Ceroplastes* has been found on the petioles of seagrape (*Coccoloba uvifera*) leaves.

Ceroplastes floridensis Comstock was collected in 1899 by Mr. August Busck, on *Annona reticulata*, altho in Florida as well as in Puerto Rico, its typical host is citrus, on which it was noted by Mr. O. W. Barrett (1903–445) and by Mr. W. V. Tower (1908–38) at Mayagüez. To these records, Mr. R. H. Van Zwaluwenburg adds mango, sweet potato and guava (*Psidium guajava*). It has since been found on coconut, banana, avocado (*Persea gratissima*), "jagua" (*Genipa americana*), "bádula" (*Rapanea guianensis*), "mangle" (*Laguncularia racemosa*), "jagüey" (*Ficus laevigata*), "laurel de la India" (*Ficus nitida*), and repeatedly on grapefruit. Despite the number of records on orange and grapefruit, it is distinctly not a pest, but merely an interesting inhabitant, rarely noted by the commercial grower.

Ceroplastes cirripediformis Comstock, collected and identified by Dr. H. L. Dozier on a *Ficus* and Passion flower vine at Bayamón (1925–366) as host for *Aneristus ceroplastae* Howard, and on lignum-vitae (1927–274) as host for *Plagiomerus cyanea* Ashmead, was earlier found on *Myrcia paniculata* at Algarrobo, and since on "cedro" (*Cedrela odorata*) at Cayey, on "palo de muñeca" (*Rauwolfia tetraphylla*) at Guayama, on *Chinchona* at Mayagüez.

Ceroplastes ceriferus (Anderson), collected by Mr. D. L. Van Dine on "almácigo" (*Elaphrium simaruba*) at Guánica in 1911, has been found only once since, on *Sauvagesia erecta* at Naguabo.

Ceroplastes cistudiformis Townsend and Cockerell is listed by Mr. R. H. Van Zwaluwenburg on *Euphorbia robusta* and on *Ipomoea fastigata*.

The intrinsic beauty of the African cloth bark trees, *Ficus nekbuda*, first planted in Muñoz Rivera Park, Puerta de Tierra, was flawed by the coating of sooty mold that soon darkened every leaf. This black fungus grows on the excretions of **Ceroplastes denudatus** Cockerell, a wax scale not known to exist in Puerto Rico before these trees had been imported, and presumably brought in with them. This is not the only host on which the scale can exist, however, for coconuts growing near the cloth bark trees have also become infested with this wax scale. At Camp Buchanan, the ornamental edging plant, "jamón con huevo" (*Achyranthes bettzickiana*), was so heavily infested that partial defoliation resulted. Most recently it has been found on lignum-vitae (*Guaiacum officinale*) at Guánica, and in the meantime has quite disappeared from the cloth bark trees in Muñoz Rivera Park, where it was formerly so abundant.

Vinsonia stellifera (Westwood) is unlike any other Puerto Rican scale insect in appearance, for its waxy covering naturally develops into a four, five or six pointed star. In Puerto Rico, Mr. August Busck first collected it on the fronds of the coconut, which is still a common host, on which it may almost invariably be found, at least in small numbers. It also occurs on other hosts, Mr. O. W. Barrett (1903–446) mentioning "pomarrosa" (*Eugenia jambos*), and Mr. R. H. Van Zwaluwenburg listing mango, guava (*Psidium guajava*), sisal (*Agave sisalana*) and Manila hemp (*Musa textilis*). It has repeatedly been collected on the mangosteen (*Garcinia mangostana*), and on such botanically unrelated hosts as orchid leaves, "guinda" (*Arthurium scandens*), "resedá" (*Lawsonia inermis*), "cucubano" (*Coccoloba laurifolia*) and "mamey zapote" (*Achras zapota*) on Vieques Island. Despite the number of records, it is not really abundant, and is of negligible economic importance. On mango leaves it has been found killed by the entomogenous fungus *Aschersonia cubensis* B. & C., as determined by Miss Vera K. Charles, who also records it as host for *Aschersonia turbinata*.

Inglisia vitrae Cockerell has been collected in Puerto Rico on pigeon peas, on "achiote" (*Bixa orellana*), and on the coffee shade tree *Inga vera*.

Eucalymnatus tessellatus Signoret was first identified from Puerto Rico on mango by Mr. G. B. Merrill, and by Dr. E. W. Berger, reporting on "Natural Enemies of Scale Insects and Whiteflies in Florida" (Quarterly Bulletin Florida State Plant Board, 5 (3): 141–154, fig. 10. Gainesville, April 1921), as killed by the entomogenous fungus *Aschersonia cubensis*. It was collected by Dr. H. L. Dozier on "María" (*Calophyllum antillanum*), which is its most common host in the mountains, and found to be the host of the parasitic wasp *Aneristus ceroplastae* Howard. Dr. Harold Morrison identified it from "tortugo amarillo" (*Sideroxylon foetidissimum*) on Mona Island, and from Malay apple (*Jambos malaccensis*) at Trujillo Alto.

The leaves of the hedge of Malay apple (*Jambos malaccensis*) at Trujillo Alto are also infested with a soft green scale, **Coccus acuminatus** (Signoret), as identified by Dr. Harold Morrison. It has been found on the leaves of "achiote" (*Bixa orellana*) at Salinas, and of "dormidera" (*Emelista tora*) at Barceloneta. These are only minor and incidental hosts, however, for this scale is normally so abundant on the leaves of "pomarrosa" (*Eugenia jambos*) that all its older leaves are blackened with the sooty mold growing on its excrement. At a distance, thickets of pomarrosa appear almost black, and invariably much darker than other trees growing in the same region. Miss Vera K. Charles records this scale attacked by the entomogenous fungus *Hypocrella caulium*.

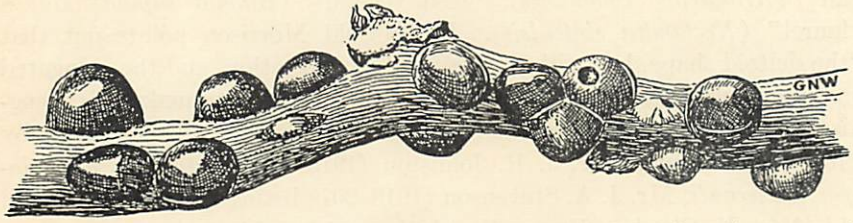
Coccus hesperidum (Linnaeus) is considered by Dr. H. L. Dozier (1926–118) to be no more abundant in Puerto Rico because of its being heavily parasitized by the wasp *Coccophagus lunulatus* Howard. This soft scale has been collected on "maguey" (*Agave americana*) at Río

Piedras and Trujillo Alto, on "grosella" (*Phyllanthus distichus*), on banana at Arecibo, and on "buenas tardes" (*Hibiscus bifurcatus*) at Vega Alta. A colony on the underside of papaya leaves at Guánica was partially covered with a carton shelter built by the ant *Crematogaster steinheili* Forel, and it has also been found on this host at Río Piedras and Luquillo by Mr. Francisco Seín, but attended by the "hormiga brava," *Solenopsis geminata*.

The tender unfolding leaves of the mango are pink or reddish when they first develop, but soon turn a light green that darkens as they become hard and mature. Seen from a distance, however, the foliage of mango trees is much darker, tending to be almost black. This is due to a film of sooty mold with which practically every old leaf is covered, a sooty mold similar to that on other trees infested with honey-dew secreting insects. On mango this is a soft green scale, **Coccus mangiferae** (Green), which at times also occurs on the leaves of "pomarrosa" (*Eugenia jambos*), "palo de pan" (*Artocarpus communis*), "seso vegetal" (*Blighia sapida*) and a "laurel" (*Nectandra sintenisii*). Dr. Harold Morrison points out that "the deltoid shape, but without the fringes of secretion, and the elongated anal plates with outer angles near apices, should serve to make this recognizable where it is found on mango". To some extent it is controlled by entomogenous fungi, Dr. J. R. Johnston (1915–19) mentioning *Cephalosporium lecanii*, Mr. J. A. Stevenson (1918–207) listing *Botrytis rileyi*, and Miss Vera K. Charles, *Hypocrella* (*Aschersonia*) *turbinata*.

These fungi, especially the first, are also responsible for the economic control of "The Green Scale, **Coccus viridis** (Green), a New Pest in Coffee and Citrus" (Agr. Notes No. 48, Agr. Exp. Station, Mayagüez, pp. 2., July 1929), which, when reported by Messrs. T. B. McClelland and C. M. Tucker, had first appeared as a serious pest of coffee at Villalba in 1927. From Villalba it had rapidly spread to coffee groves in all parts of the Island, later attacking grapefruit, lime and guava bushes (*Psidium guajava*) along the coast. In coffee groves, its sweetish secretions proved especially attractive to the "albayalde", but it was also in humid coffee groves that control by entomogenous fungi most nearly attained total effectiveness. As a new pest, it attacked the Meyer lemon (*Citrus excelsa* var. *davaoensis*) trees at Isabela Substation in such numbers as to threaten their very existence. In later years, commercial oil sprays on grapefruit, plus natural control in coffee groves changed the status of *Coccus viridis* to merely that of one more minor pest. Many forest trees also serve as host to a minor extent, possibly the most interesting being "tortugo amarillo" (*Sideroxylon foetidissimum*), of which infested leaves have been found at Guánica and on Mona Island. Messrs. H. K. Plank and H. F. Winters found it attacking *Chinchona* spp. in the mountains back of Mayagüez.

Saissetia hemisphaerica (Targioni), the hemispherical scale, is one of the most common and certainly one of the most conspicuous of scale insects. The adult females are shining, chestnut-colored hemispheres, often so abundant as to entirely cover infested twigs. They are so obvious that even lizards eat them, and Dr. Alex. Wetmore found them in the stomachs of the tody, the parula warbler, the oriole, the tanager and the mozambique. The "hormiga brava" (*Solenopsis geminata* F.) is almost invariably associated with mass infestations of the hemispherical scale, collecting its excretions so promptly that rarely does enough fall on surrounding leaves to develop a suitable medium for the growth of sooty molds. Despite what seems to us such powerful protection against most enemies, at least two parasitic wasps have been reared from it: Dr. H. L. Dozier (1925–367) reporting *Aneristus ceroplastae* Howard, and Dr. M. R. Smith (1942–23) *Encyrtus infelix* Embleton. In a humid environment, such as a coffee grove, the hemispherical scale may be completely wiped out by



Colony of *Saissetia hemisphaerica* (Targioni) on stem of balsam, four times natural size. (Original.)

Cephalosporium lecanii, with the margins of each dead scale outlined with white mycelium on the host. Miss Vera K. Charles (1941–710 and 762) also lists *Torrubiella lecanii* and *Aschersonia cubensis* as entomogenous fungi attacking the hemispherical scale.

Every host of *Coccus viridis*, and many others, including cotton, okra and many vegetables, mistletoe, the cycad *Zamia latifoliata*, the sago palm *Cycas revoluta*, and many fruit and forest trees, including chinchona, are subject to attack by the hemispherical scale. On Mona Island it has been noted on eggplant, "almendra" (*Terminalia catappa*), seagrape (*Coccoloba uvifera*), "cucubano" (*Coccoloba laurifolia*) and "tortugo amarillo" (*Sideroxylon foetidissimum*).

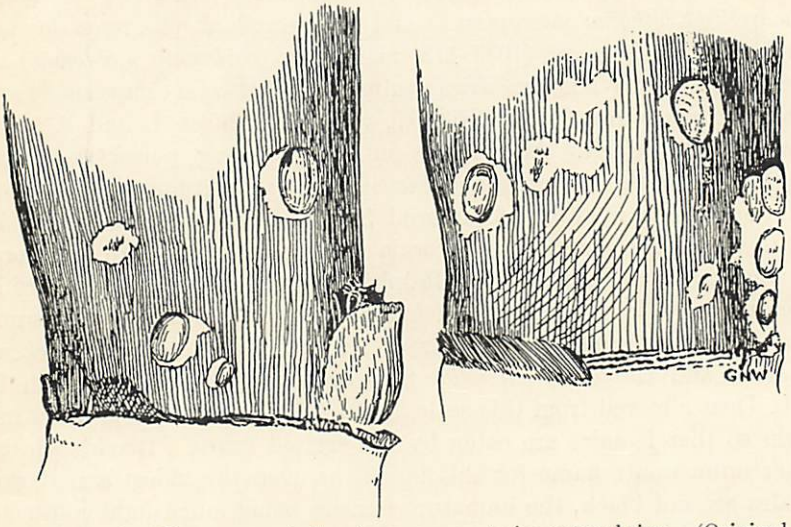
Saissetia oleae (Bernard), in California called the black scale, is considered by California citrus growers their most serious pest, according to Prof. E. O. Essig, "being responsible for losses of more than two million dollars to fruit growers in California alone". In Puerto Rico it can hardly be considered an economic pest at all. Altho it sometimes does occur on citrus and some forest trees, mass infestations are usually on

"almendra" (*Terminalia catappa*), on which it was first noted in Puerto Rico by Mr. August Busck, and on which it is common on Mona Island, as well as here. Mr. R. H. Van Zwaluwenburg lists in addition, orange, oleander (*Nerium oleander*), "guácima" (*Guazuma ulmifolia*), "bucare" (*Erythrina micropteryx*) and wild eggplant (*Solanum torvum*), and Dr. M. D. Leonard (1933–118) mahogany (*Swietenia mahagoni*) and *Vitex altissima*. When the African tulip tree (*Spathodea campanulata*) was first introduced into Puerto Rico, it was often infested, and it still is susceptible to attack. After it has finished blooming, poinsettia is often attacked. Both *Ficus nitida* and *Ficus laevigata* sometimes serve as hosts, and the specific identity of material from a mass infestation on *Ficus stahlii* at Ponce, sent to California for comparison with California specimens, was confirmed by Dr. Ralph H. Smith. Dr. Luis F. Martorell, collecting records on forest trees, found that most economic or common species were infested to a greater or less extent. *Lecanobius cockerelli* Ashmead and *Eupelmus saissetiae* Silvestri are the parasites which Dr. H. L. Dozier reared from this scale, and it is of sufficient size when fully grown so that females are eaten by the crested lizard. Black scale is a rather unfortunate name for this insect, as even the oldest and darkest females are not black, the immature females being much lighter in color, and distinguished by two transverse and one longitudinal ridge across the back which forms a very distinct and conspicuous letter "H".

Saissetia nigra (Nietner) really is black, an unwrinkled shining black, or at least such a dark brown as to seem black by comparison with other scale insects. Mr. Busck collected it on cotton and almendra, these still being common hosts, as well as other malvaceous plants, such as "maga" (*Montezuma speciosissima*), "emajagüilla" (*Thespesia populnea*) and "cadillo" (*Pavonia typhalaea*); the introduced California pepper tree (*Schinus molle*), chinaberry or "lilaila" (*Melia azedarach*), and mistletoe. From scales of this species sent to California, Dr. Stanley E. Flanders reared the following parasites and predators: *Scutellista cyanea* Motsch., *Eupelmus coccidivorus* Gahan, *Lecanobius cockerelli* Ashmead, *Coccophagus scutellaris* Dahm., *Aneristus ceroplastae* Howard, *Marietta* sp. and *Scymnus flavifrons* Melsheimer. Miss Vera K. Charles (1941–717) records this scale as host of the entomogenous fungus *Cephalosporium lecanii*.

Very different in its habits and appearance from the other Coccinae is **Aclerda sacchari,** described by M. M. Teague (Ann. Ent. Soc. America, 18 (4): 433–441, pl. 3. Columbus, December 1925), the type from sugarcane stalks and root-stalks at Guánica. The purplish-grey, oval young, flattened between leaf-sheath and root-stalk, develop into what look like fully-engorged ticks, but dark brown and fragile, surrounded by a halo of white wax. Recorded first from Puerto Rico under the incorrect name of

Aclerda tokionis Cockerell, they are so scarce as to be of no economic importance, but nevertheless something for which to search if one is to know every insect infesting sugar-cane in Puerto Rico.



Aclerda sacchari Teague, on stalks of sugar-cane, twice natural size. (Original.)

The excess carbohydrates in the cell sap of the plant on which the scale insect feeds, for which its sedentary mode of life finds no use, may be excreted as a sweet syrupy liquid which attracts ants, or fall on surrounding vegetation and be a culture medium for the growth of sooty mold fungi. Or it may be eliminated as filaments of wax, to cover the eggs, or forming a halo around the insect, or in the case of the wax scales as soft amorphous wax to cover the insect. The armored scales (Diaspinae) secrete a somewhat different type of wax or gum, which hardens on their backs to form a much harder, tougher and more resistant covering, a veritable armor for the insect underneath. The females of the so-called white scale of citrus, *Chionaspis citri* Comstock, now called **Unaspis citri** (Comstock), are not white at all, but of the uncertain dull hues, dark grey or reddish-brown, of their armored covering. The very accurately descriptive name for this scale is derived from the males, which are white in color, oblong in shape, with three parallel longitudinal ridges, the head end being somewhat constricted in a small bright yellow area. They are often much more abundant than the females, and naturally much more conspicuous against the dark bark of the citrus tree. Normally, the white scale occurs mostly on the trunk of the tree, but is also to be found on twigs, leaves and fruit. Mr. August Busck collected it on lime at Añasco, but it is common on

orange and grapefruit, being, after the equally host-restricted purple scale, *Lepidosaphes beckii* (Newman), the most injurious scale insect pest of the citrus groves of Puerto Rico. From it, Dr. H. L. Dozier reared no internal parasite, and it is not fed upon by any endemic ladybeetle, but the introduced *Chilocorus cacti* is often seen in citrus groves, presumably feeding on this and other scales present. In the more humid groves, protected from the action of the wind by surrounding hills or windbreaks of bamboo or the remnants of virgin forest, entomogenous fungi may be an important factor in control. Mr. John A. Stevenson in his "Check List of Porto Rican Fungi and a Host Index" (Jour. Dept. Agr. P. R., **2** (3): 125–264. San Juan, July 1918) lists *Myriangium duriaei*, *Septobasidium spongium* and *Tubercularia coccicola*, the latter being listed as a *Podonectria* by Miss Vera K. Charles in her "Preliminary Check List of the Entomogenous Fungi of North America" (Insect Pest Survey Bulletin, **21** (Supplement to No. 9): 707–785. Washington, D. C., November 10, 1941) in addition to its imperfect stage as a *Tetracrium*.

From the grass "burrillo" (*Sporobolus berteroanus*) growing on the beach at Arecibo in May 1921, an abundance of material was collected which Dr. Harold Morrison tentatively identified as *Chionaspis* "near *spartinae*", and subsequently placed as **Chionaspis distichlii** Ferris with the notation "differing in several small details".

Howardia biclavis (Comstock) was first collected in Puerto Rico by Mr. August Busck on "achiote" (*Bixa orellana*), and has repeatedly been found on this host since. Dr. C. W. Hooker reports it on "mamey zapote" (*Achras zapota*), on "mamey" (*Mammea americana*), on "manzana cafre" (*Doryallis caffra*) and on coffee, to which Mr. R. H. Van Zwaluwenburg adds "alhelí" (*Plumiera rubra*) and Mr. H. K. Plank, chinchona. Dr. H. L. Dozier (1927–273) from material on the ornamental *Acalypha wilkesiana* reared the parasitic wasp *Pseudopteroptrix imitatrix* Fullaway and Mr. J. A. Stevenson (1918–134) lists it as host of the entomogenous fungus *Myrangium duriaei*. In addition to the hosts mentioned, it has been found on "caimito" (*Chrysophyllum cainito*), "algarrobo" (*Hymenaea courbaril*), "jagua" (*Genipa americana*), "roble" (*Tabebuia pallida*), "guara" (*Cupania triquetra*), "cedro" (*Cedrela odorata*), "madre de cacao" (*Gliricidia sepium*), oleander (*Nerium oleander*), "hoja menuda" (*Myrcia citrifolia*), "guía verde" (*Casearia arborea*), "serrasuela" (*Guettarda scabra*), "malvavisco" (*Waltheria americana*), beefwood (*Casuarina equisetifolia*), rubber tree (*Castilla elastica*) and the ornamental *Monstera deliciosa*.

Diaspis boisduvalli Signoret is a serious pest for the orchid grower, but except on orchids, has been found in Puerto Rico only on Malay apple (*Jambos malaccensis*).

Diaspis bromeliae (Kern), a grey or whitish scale often seen on pine-

apples near the base of the leaves or scales, is not noticeably injurious, and has been found on no other host in Puerto Rico.

Diaspis echinocacti (Bouché) is equally common on cacti. It was first collected in Puerto Rico by Mr. August Busck, who listed it as *Diaspis calyptroides* Costa var. *opuntiae* Cockerell, and has been noted many times since, but only on cacti.

Lepidosaphes beckii (Newman), the purple or oyster-shell scale, as normally infests the twigs, leaves and fruit of citrus trees in Puerto Rico as the white scale does their trunks. The two together constituted the main reason why citrus trees must be sprayed with oil sprays if they were to produce a crop of fruit. During wet weather, and more especially in groves protected against the drying action of wind by hills or windbreaks, the entomogenous fungi might effect commercial control, and certainly the list of fungi attacking the purple scale is very impressive. Those listed by Dr. John R. Johnston, Mr. J. A. Stevenson and Miss Vera K. Charles from Puerto Rico are: *Aschersonia turbinata*, *Scoleconectria coccicola*, *Sphaerostilbe aurantiicola* (= *S. coccophila*), *Septobasidium spongium*, *Myrangium duriaei*, *Microcera fujikuroi* and *Tetracrium* (*Tubercularia*) *coccicola*.

Even under the most favorable conditions, these fungi caused only an approximation of commercial control, and when the advent of citrus scab necessitated the elimination of windbreaks to lessen the humidity that favored scab fungus, oil spraying became a necessity. The purple scale has but a single known parasite in Puerto Rico, the Aphelinid wasp *Aspidiotiphagus citrinus* Craw, altho in its host relationships, this wasp is not confined to attacking the purple scale.

Dr. Richard T. Cotton discovered that "The Scale-Feeding Habits of a Porto Rican Millipede, *Rhinocritus arboreus* Saussure" (Jour. Dept. Agr. P. R., 1 (3): 175–6. San Juan, July 1917) might be very effective in cleaning citrus trees of this scale, but actually this had no wide commercial application. Now that the commercial grapefruit industry has ceased to be of major importance, one of the ladybeetles brought to Puerto Rico to feed on the scale of bamboo proves to be an important predator on many other kinds of scales. Not only has the twice-stabbed ladybeetle, *Chilocorus cacti* (L.), been observed to feed on the purple scale, but it occurs in sufficient numbers and continues with such persistence that entire groves are reported to have been cleaned of the scale by it alone.

"**Lepidosaphes gloverii** (Packard) is another citrus-infesting species somewhat resembling the purple scale, but it readily distinguished by its paler color and the much narrower scales", according to Prof. E. O. Essig. It is a rare species in Puerto Rico, having been intercepted here but three times: on grapefruit, lime and guava (*Psidium guajava*), as identified by Dr. Harold Morrison.

Lepidosaphes crotonis Cockerell, as identified by Dr. Harold Morrison, has been found on the coffee shade tree, *Inga vera*, at Utuado.

Lepidosaphes lasianthi Green, which according to Dr. G. F. Ferris is *Lepidosaphes tokionis* Kuwana, has been found on ornamental croton (*Croton humilis*) at Río Piedras, Santurce and Bayamón.

Parlatoria pergandii Comstock, as identified by Dr. Harold Morrison, has been intercepted on grapefruit, tangerine and kumquat in groves along the north coast.

Ischnaspis longirostris Signoret, the black thread scale, was first collected in Puerto Rico by Mr. August Busck on coconut palm at Caguas, Cataño and Mayagüez, and it has since often been noted on this host. Mr. R. H. Van Zwaluwenburg lists royal palm (*Roystonea borinquena*), the Washington palm, (*Neowashingtonia robusta*), "palo de pollo" (*Pterocarpus draco*), and a liana, *Bignonia unguis-cati*. This is a very partial list of hosts, for it has since been found on the corozo, areca, kentia and other ornamental palms, on the asparagus fern (*Asparagus sprengeri*), jasmin, (*Jasminum sambac*), "péndula" (*Cithrarexylum fruticosum*), "membrillo" (*Dalbergia monetaria*), "guaraguao" (*Guarea trichilioides*) and "palo de hierro" (*Ixora ferrea*). Dr. C. W. Hooker reported it on *Ficus repens* at Mayagüez, Dr. Luis F. Martorell (1940–24) on Honduras mahogany (*Swietenia macrophylla*) and Dr. M. R. Smith (1942–23) on coffee. It has been repeatedly noted on the leaves of "laurel de la India" (*Ficus nitida*), those on the road up El Yunque being attacked by the "red-headed fungus", *Sphaerostilbe aurantiicola*, as identified by Miss Charles, who also records attack by *Microcera fujikuroi*.

Pseudaulacaspis pentagona (Targioni), in the older literature referred to as a *Diaspis* or an *Aulacaspis*, was first collected by Mr. August Busck on castor-oil plant at Río Piedras, on honey-locust, on "majagua" at Fajardo and on peach at Adjuntas. Mr. O. W. Barett (1903–446) notes it as very destructive to peach trees in the eastern part of the Island, and also attacking mulberry and pawpaw, to which Mr. W. V. Tower (1907–27) adds plum. Whether because of this scale or for other reasons, peach and plum trees no longer exist in Puerto Rico, and the name "West Indian peach scale" seems most inappropriate. Yet in Hispaniola, at higher altitudes than those under cultivation in Puerto Rico, peach trees are still grown, despite constant infestation by this scale. It is one reason why imported ash (*Fraxinus* sp.) trees failed to thrive in Puerto Rico, and the chinchona trees planted on the barren, wind-swept ridges around Maricao. Almost the only susceptible imported tree to survive is Humboldt's willow (*Salix chilensis*), and various species of mulberry (*Morus* spp.), none of which is at all abundant. Cotton and various malvaceous plants and trees, oleander, cultivated pepper plants and various wild Solanums, besides

numerous native forest trees are sometimes attacked, but the principal host is papaya (*Carica papaya*), so often infested that the scale is most appropriately known at present as the white scale of papaya. In attempting to control the scale on papaya, the oil sprays that had been used so successfully in citrus groves, proved to be equally effective against the papaya scale, but they were also toxic to the host, the leaves of which withered almost as soon as the tree was sprayed. Later developments produced sprays that could be safely used even on tender papaya, but when such sprays became commercially available, it was found that they were quite unnecessary. Water alone, under high pressure from a modern orchard sprayer will dislodge the scales from the smooth cylinder that is the naked trunk of the papaya with an effectiveness that is close to perfection, if the spraying is commenced while only the trunk is infested. The entomogenous fungus *Myrangium duriaei* attacks this scale during wet weather and Dr. H. L. Dozier (1927–277) found it parasitized by *Aspidiotiphagus lounsburyi* Berlese & Paoli. *Aspidiotiphagus citrinus* (Craw) and *Prospaltella diaspidicola* Silvestri have been reared by Dr. Kenneth A. Bartlett, reporting on "The Introduction into Puerto Rico of a Parasite, *Prospaltella berlesei* (Howard), of the White Scale of Papaya" (Agricultural Notes No. 85, pp. 2. P. R. Exp. Station, Mayagüez, March 12, 1938). The most nearly effective of its natural enemies, however, is the imported twice-stabbed ladybeetle, *Chilocorus cacti* L., of which large colonies are often seen on heavily infested papayas. Attempting to transfer some of these beetles to infested trees is rarely a success, for the lizards living on each tree snap them up before their conspicuous black bodies can find concealment on the scale-infested, but otherwise naked trunks of the host.

Aulacaspis (Pseudaulacaspis) major (Cockerell), as identified by Dr. Harold Morrison, was found associated with other scales killing numerous terminal branches of "guara" (*Cupania americana*) at Manatí in September 1940: the only record of this scale from Puerto Rico.

The status of the name of the white scale which Mr. August Busck reports as *Hemichionaspis minor* Maskell, on eggplant at Cataño, and on "guácima" (*Guazuma ulmifolia*) at Guayama, is uncertain and presumably is "not *minor* of Maskell, better as **Pinnaspis strachani** (Cooley)", according to Dr. Harold Morrison. Elsewhere in the tropics it may become a serious pest on cultivated cotton, but has little chance to become abundant on Sea Island cotton in Puerto Rico because of its short crop season. On wild or tree cotton, in Puerto Rico and on Mona Island, it often covers the trunk with a thick white crust, and, to a lesser extent, other malvaceous plants such as "emajagua" (*Pariti tiliaceum*) and "maga" (*Montezuma speciosissima*). It may also attack quite unrelated plants, as mahogany

and eggplant on Mona Island, and in Puerto Rico, most recent records: on "almendrota" (*Barringtonia speciosa*), on "abeyuelo" (*Colubrina ferruginosa*) at Guajataca, on "aceitillo" (*Zanthoxylum flavum*), on "guacimilla" (*Trema micrantha*) at Aguas Buenas, Maricao and on El Yunque. In recent years one may often note the presence of the introduced twice-stabbed ladybeetle, *Chilocorus cacti* L., feeding on the scales. Miss Vera K. Charles lists the white scale as host for the entomogenous fungi *Sphaerostilbe aurantiicola* and *Tubercularia coccicola*.

Pinnaspis buxi (Bouché), a semitransparent, papery, yellowish-brown, oystershell-shaped scale, occurs on the corozo, areca and other ornamental palms, on mistletoe and bromeliads, and may become a serious pest in the commercial production of ornamentals, attacking *Philodendron* spp. and "sanseviera" (*Cordyline terminalis*). As determined by Dr. Harold Morrison, it has been noted recently on *Ilex vomitaria*, introduced from Texas, differing greatly in gross appearance, the scales being oval, very convex and opaquely chalky white or grey in color, matching the bark of the host.

Pinnaspis aspidistrae (Signoret), as identified by Mr. E. R. Sasscer, has been found on the fronds of the Boston fern, *Nephrolepsis exaltata* var. *bostoniensis*.

Dr. C. L. Marlatt described **Leucaspis indica** (Bulletin No. 16, Technical Series, pt. II, pp. 26–27, Bureau of Entomology, Washington D. C., 1908) from material collected on mango at Mayagüez, Puerto Rico, on varieties imported from India, but it has not since been noted.

Aspidiotus destructor Signoret is the most common scale on coconut palm fronds, its round, semitransparent shells, yellow and opaque only in the center, being almost invariably present on the pinnae of mature or fallen fronds. Heavily infested pinnae turn yellow and then become brown and dead, but the actual damage to the tree is questionable because the young fronds are rarely infested. A minute greenish wasp, *Aphelinus chrysomphali* Mercet, is a common parasite of the coconut scale, and may often be seen wandering around over the scales. No native ladybeetle is at all common on coconut palms growing along the beaches of Puerto Rico, and those feeding on this scale in Trinidad, imported into Puerto Rico, find the high winds not at all to their liking. On Mona Island, the twice-stabbed ladybeetle, *Chilocorus cacti* L., (which, so far as we know, got across from Mayagüez by its own efforts) has changed the status of this scale on coconuts so markedly that often mature fronds fall of which the pinnae are still entirely green. A single tree of *Barringtonia speciosa* on Mona, when observed in April 1944, had had its leaves so recently cleaned of this scale that the marks of its former presence were still visible. The coconut scale was first reported from Puerto Rico by Prof. T. D. A.

Cockerell in 1895 (Canadian Entomologist, **27** (9): 253–261), the material having been collected by Mr. J. D. Hill. Mr. August Busck found it only on banana leaves, altho in 1902, Mr. O. W. Barrett reported many coconut trees at Ponce dead from the mass attacks of this scale. Besides coconut palms and bananas, the leaves of aguacate, pomegranate, "mamey" (*Mammea americana*), "almendra" (*Terminalia catappa*), guava (*Psidium guajava*), "corcho" (*Annona pulustris*), the screw palm (*Pandanus* sp.) and the Australian silk oak (*Grevillea robusta*) have been found infested. Dr. H. L. Dozier (1927–277) reared the parasitic wasp *Aspidiotiphagus lounsburyi* Berlesi & Paoli from this scale; Mr. J. A. Stevenson (1918–207) found scales on coconut at Pt. Cangrejos attacked by *Botrytis rileyi*, and Miss Vera K. Charles (1941–717) records attack by *Cephalosporium lecanii*.

Aspidiotus arctostaphyli Cockerell & Robinson, as determined by Dr. H. L. Dozier, was found by him under the leafsheaths of the white-striped variety of gramma grass (*Stenotaphrum secundatum*) at Río Piedras.

Aspidiotus camelliae (Signoret), as identified by Dr. Harold Morrison, has been intercepted on grapefruit at Trujillo Alto.

Aspidiotus hederae (Vallot), as identified by Dr. Harold Morrison, has been intercepted on grapefruit at Trujillo Alto.

Aspidiotus herculaneus Hadden, as determined by Dr. Harold Morrison, has been intercepted on mistletoe (*Phoradendron randiae*) and on "roble" (*Tabebuia pallida*).

Aspidiotus lataniae Signoret, first reported by Dr. C. W. Hooker on rubber (*Castilla elastica*) at Mayagüez, has since been identified by Dr. Harold Morrison from *Jasminum sambac* on Monte Flores Hill, Santurce; from "mamey zapote" (*Achras zapota*) at Naguabo and from "cóbana negra" (*Stahlia monosperma*) at Guánica. Miss Vera K. Charles (1941–758) reports this scale attacked by the entomogenous fungus *Sphaerostilbe aurantiicola*.

Aspidiotus palmae Cockerell, collected by Mr. Thos. H. Jones on eucalyptus at Naguabo in March 1914, was originally identified as *A. cyanophylli* Signoret, and Van Zwaluwenburg's list under the latter name gives nineteen host records. The only recent record is on leaves of "laurel de la India" (*Ficus nitida*) in Muñoz Rivera Park, Puerta de Tierra, in July 1946.

Targionia sacchari (Cockerell), in all the earlier records called an *Aspidiotus*, was first noted in Puerto Rico by Mr. D. L. Van Dine, occurring under the leafsheaths of sugar-cane on the root-stalk and at the base of the stalk just above the surface of the ground. It is a very minor pest of sugar-cane, but quite abundant, much more so than *Aclerda sacchari* Teague. Mr. J. D. Hood (Insecutor Inscitiae Menstruus, 1 (6): 65–70. Washington, D. C., June 1913) reports this scale as found under the leafsheaths of "malojillo" (*Panicum barbinode*) at Guánica.

Pseudaonidia tesserata (de Charmoy), twice found infesting cultivated roses, has also been noted on the twigs of *Inga laurina* at Lares, as identified by Prof. G. F. Ferris.

Selenaspidus articulatus (Morgan), in some of the earlier records called *Pseudaonidia*, was first collected in Puerto Rico by Mr. August Busck on wild orange on El Yunque, at about 2,000 ft. elevation, presumably in Hda. Santa Catalina. It is a round, almost flat, semitransparent, reddish-brown scale, called the "West Indian Red" scale by grapefruit growers, when it later became a major pest in their groves. Of minor importance on grapefruit leaves, on the fruit it gives a freckled appearance, and is the most difficult to remove of any scale when the fruit is being scrubbed and washed for shipment. The Federal Plant Quarantine inspectors made nearly twice as many interceptions of this scale on grapefruit as of any other scale, besides many on orange, two on wild orange or "naranja" (*Citrus aurantium*) and one on kumquat. At Ponce, Cabo Rojo and Mayagüez they intercepted it on tamarind (*Tamarindus indica*), indicating its presence in all parts of the Island, from the most humid on El Yunque to the most xerophytic at Cabo Rojo. Their other interceptions were on *Dracaena fragrans*, on *Malachra alceifolia* at Bayamón, on *Antidesma bunius* at Mayagüez, on *Pothomorphe peltata* at Guaynabo, on *Emelista tora* at Barceloneta, on *Thyella tamnifolia* at Manatí, on *Brunfelsia americana* at Pueblo Viejo, on banana at Arecibo, and corazón at Ponce. It has also been collected on coffee, caimito, pomarrosa and eucalyptus, but is most often noted on the leaves of "laurel de la India" (*Ficus nitida*), being especially noticeable on the freshly fallen yellow leaves. Mr. J. A. Stevenson (1918–219) found it attacked by the entomogenous fungus *Microcera fujikuroi*, and Miss Vera K. Charles lists *Sphaerostilbe aurantiicola*, but no parasitic wasp has been reared from it.

Aonidiella aurantii (Maskell), the so-called "California Red" scale, in older records given as a *Chrysomphalus*, did not occur in Puerto Rico, according to Mr. Harold Compere, until recently, despite the records by Mr. O. W. Barrett (1903–445) on citrus stock, "rare but apparently spreading", listing by Mr. R. H. Van Zwaluwenburg on orange and rose, and the record by Mr. E. G. Smyth on *Murraya exotica*. It was brought in from California, however, around 1936 or earlier, on lemon trees that were planted at Trujillo Alto, whence it spread to orange, kumquat and grapefruit and has been intercepted on these hosts at Río Piedras and Bayamón.

Aonidiella comperei McKenzie is Dr. Harold Morrison's redetermination of the material collected by Mr. August Busck on "guanábana" (*Annona muricata*) at San Juan and Ponce which was reported under the name *Chrysomphalus aurantii* Maskell.

Aonidiella orientalis Newstead (= *Aspidiotus cocotiphagus* Marlatt) was

first collected in Puerto Rico on *Jasminum sambac* on Monte Flores Hill (Santurce) in September 1923, associated with other scales, as determined by Dr. Harold Morrison, but it may occur alone, as Mr. Francisco Seín found the greasy, semitransparent yellow female scales and the plump, white male scales very abundant on the stems of native lima beans (*Vicia faba*) at Guaynabo in February 1943. It occurs on a great diversity of hosts: cultivated grapes, roses, the famous hedge around the Federal Building in San Juan of "café de la India" (*Chalcas* or *Murraya exotica*), banana, tamarind, avocado, hibiscus, "María" (*Calophyllum antillanum*), "aceitillo" (*Zanthoxylum flavum*) at Guánica, and most often on the fronds of the coconut palm.

Chrysomphalus aonidum (Linnaeus), the so-called "Florida Red" scale, is recorded as occurring on grapefruit in Puerto Rico, but rarely in sufficient abundance to be considered an economic pest. It is more abundant on orange and lemon, and because of numerous records on "laurel de la India" (*Ficus nitida*), its other name of *Chrysomphalus* or *Aspidiotus ficus* seems most appropriate. Mr. August Busck collected it on "almendra" (*Terminalia catappa*) at San Juan, on "guanábana" (*Annona muricata*) at San Juan, on oleander at Ponce and on *Musa* at Caguas. Oleander, rose, pomelo, coconut and sisal are added in Van Zwaluwenburg's list, the most recent collections having been made on "mamey del cura" (*Taonabo stahlii*) at Dorado and "almendrota" (*Barringtonia speciosa*), with scales identified by Dr. Harold Morrison. Dr. John R. Johnson (1915–29) records attack on this scale by the entomogenous fungus *Sphaerostilbe coccophila*, and Mr. John A. Stevenson (1918–219) by *Microcera fujikuroi*.

Chrysomphalus dictyospermi (Morgan), as identified by Mr. E. R. Sasscer, was first collected in Puerto Rico by Mr. Thos. H. Jones on mango and on coconut palms, and has since been found on kentia palm at Trujillo Alto, on guava (*Psidium guajava*), and on roses at Bayamón. Heaviest infestations have been noted on the Cycad (*Cycas revoluta*) at Río Piedras and Naguabo.

Chrysomphalus nigropunctatus Cockerell, as identified by Dr. Harold Morrison, was observed heavily infesting the trunk and branches of several trees of lignum-vitae or "guayacán" (*Guaiacum officinale*) on the beach at Salinas.

Chrysomphalus (Melanaspis) portoricensis, described by L. Lindinger (Zeitschrift f. Wissen. Insektbiol., 6 (12): 441. 1910 and 7 (1): 9. 1911) the type from "calambreña" (*Coccoloba excoriata* = *C. venosa*) at Cayey, near Las Cruces, is apparently or "close to" what has since been found on seagrape (*Coccoloba uvifera*) on the beach at Luquillo, and in much greater

abundance temporarily on seagrape at Río Piedras, away from the normal wind-swept beach environment of the host plant, and on *Coccoloba pirifolia* at Maricao.

"**Melanaspis (Hemigymnaspis) eugeniae** sp. nov. aus Porto Rico (Homoptera: Coccidae)" described by L. Lindinger (Entomologische Rundschau, **51** (5): 45–46. March 1, 1934) "auf dem Berg Ciénaga bei Adjuntas" on the leaves of *Eugenia cordata* DC, has subsequently been collected, according to identifications by both Dr. Harold Morrison and Prof. G. F. Ferris, on the leaves of "guayabota de sierra" (*Eugenia borinquensis*) growing on the top of El Yunque rock, and on the trail to the rock: small round black and larger lighter-colored scales present in abundance, along with moss and lichens, on the leaves of the host.

Chrysomphalus personatus (Comstock) was collected by Mr. August Busck on "guanábana" (*Annona muricata*) at San Juan, on banana leaves at Cataño, on plantain leaves at Caguas and on coconut palm at Mayagüez. Mr. Thos. H. Jones (1917–13) found this scale on mango at Santa Isabel and on "laurel de la India" (*Ficus nitida*) in the plaza at Río Piedras and at Mameyes, to which host records Mr. R. H. Van Zwaluwenburg added only *Inga laurina* and the Brazil nut, *Bertholletia excelsa*. It has since been found several times on "mamey" (*Mammea americana*), and repeatedly on *Ficus nitida*, and on eucalyptus at Naguabo, on *Jasminum sambac* at Fajardo, on *Symplocos latifolia* at Bayamón, and on "mangle" (*Laguncularia racemosa*), "María" (*Calophyllum antillanum*), "bejuco de buey" (*Banisteria laurifolia*) and "pomarrosa" (*Eugenia jambos*) at Río Piedras.

Pseudischnaspis bowreyi (Cockerell) was first reported from Puerto Rico by Dr. C. W. Hooker on asparagus at Mayagüez, and Mr. R. H. Van Zwaluwenburg lists it on rose and avocado. It has since been found attacking roses at Ponce, "jobillo" (*Spondias purpurea*) and sisal (*Agave sisalana*).

Furcaspis biformis (Cockerell), in the earlier records referred to as a *Targionia*, is the much more typical scale insect pest of sisal, mentioned by both Van Zwaluwenburg and Thos. H. Jones, and subsequently found at Trujillo Alto, Cayey, Salinas and Cabo Rojo on this host. Dr. Hooker found it on wild pineapple or "maya" (*Bromelia pinguin*), on which it has since been collected at Naguabo, Mameyes and Canóvanas. It also attacks the cycad (*Cycas revoluta*), tuberoses, and the euphorbia, *Pedilanthus tithymaloides*. In 1948 it was first found on cattleya orchids in Puerto Rico.

Pseudoparlatoria parlatorioides (Comstock) in mass infestation on the leaves of the mangrove (*Languncularia racemosa*) at Faro de Cabo Rojo, and on torchwood or "tea" (*Amyris elemifera*) at Dorado, are the only records for Puerto Rico for this scale, as identified by Dr. Harold Morrison.

Pseudoparlatoria ostreata Cockerell, the grey scale of papaya, is quite as abundant and destructive as the white scale, and both scales are sometimes noted infesting a single tree, altho normally, incipent infestations are quite distinct. The grey scale washes off papaya trunks quite easily, and is most acceptable to the introduced twice-stabbed ladybeetle, *Chilocorus cacti* L., but its alternate hosts are quite different. The bright red ornamental bush, *Acalypha wilkesiana*, has repeatedly been noted with heavy infestations, the most recent of which was promptly eliminated by ladybeetles at the Experiment Station in Río Piedras. Bushes of "dama de noche" (*Cestrum diurnum*) may be killed back to the ground, but the fresh shoots coming up from the roots will be reinfested by the time they begin to produce flowers. Infestations on the edging plant "jamón con huevo" (*Achyranthes bettzickiana*) usually end in the entire disappearance of the host. Single instances of infestation on Panamá potato, passion vine and cultivated grape have been noted. No entomogenous fungus and no parasite of this scale is recorded, but the predaceous ladybeetle, *Chilocorus cacti* L., once it becomes established, will prove to be 100% effective in cleaning up an infestation. This was most strikingly demonstrated on Mona Island, where all papaya trees had been cleaned of grey scales by 1944, so completely indeed, that one could but wonder what the "Introduced Lady Beetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, June 1944) could now find to eat.

Aleyrodidae: Whiteflies

The later larval stages of the whiteflies (Aleyrodidae) are immovably fixed in place on the host plant, like those of most of the scale insects, but unlike the scale insects, the adults of both sexes are winged. Admittedly, their flight is not active or powerful, but it renders their dispersion more rapid than that of scale insects, which must depend on the wanderings of the just hatched larvae, or accidents like crawling on the feet of birds, or transportation by man, if they are to reach new host plants. The bodies and wings of whiteflies are not of themselves white, but the entire insect is so evenly covered with a fine opaque powdery wax that it appears white.

Aleurodicus cocois (Curtis), as determined by Dr. H. L. Dozier, is common on the pinnae of coconut palm, and has also been noted in great abundance on the washingtonia (*Neowashingtonia robusta*) and fan (*Coccothrinax argentea*) palms. The much convoluted trails of whitish wax left by the female in laying her eggs terminate in the freshest egg being laid by the female. Despite the abundance of this insect, present on most of the coconut palms of the Island, the injury to the host is negligible, for rarely are any gross symptoms of infestation apparent.

Aleurodicus griseus, described by Dr. H. L. Dozier ("IB" 1936–143)

from an abundance of material on the upperside of the leaves of "hoja menuda" (*Eugenia buxifolia*) and "pitangueira" (*Eugenia ludibunda = lancea*), low bushes along the side of the road to Pt. Cangrejos which were destroyed when the widened road was constructed, has since been found on the same hosts at Palo Seco. Bushes in the Guánica forest, tentatively identified as *Myrcia cerifera*, have also been found infested with this whitefly.

Aleurodicus antillensis was described by Dr. H. L. Dozier ("IB" 1936–144) from pupa cases on coconut palm, "María" (*Calophyllum antillanum*) and "bucare" (*Erythrina glauca*) in the San Juan area, but as no subsequent collections have been made, the normal and common host of this species is unknown.

Trialeurodes variabilis (Quaintance), identified by Dr. H. L. Dozier (1926–122) as an *Aleurodicus* (*Metaleurodicus*) from the leaves of papaya (*Carica papaya*), was found by him to be parasitized by "an undescribed and very efficient species of *Encarsia*". This whitefly is common on this host in all parts of the Island, being especially abundant during periods of dry weather.

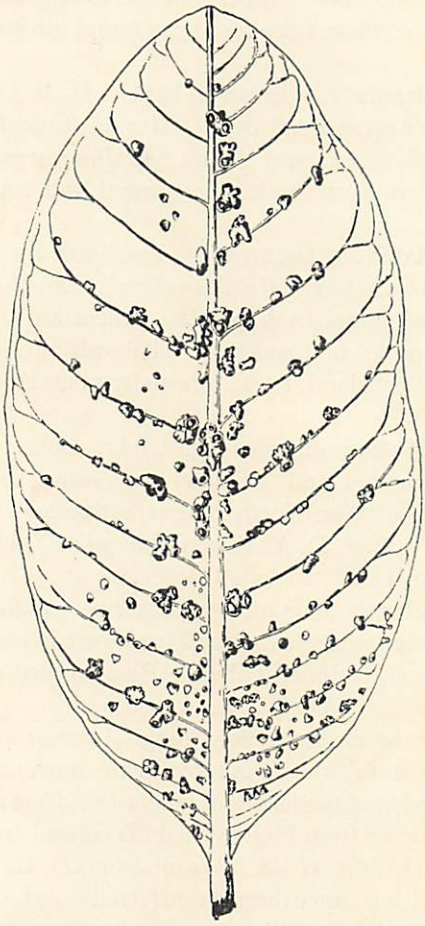
Its known distribution includes St. Croix, Cuba, southern Florida, Mexico, Central America and Trinidad, according to Miss Louise M. Russell, as recorded in "The North American Species of Whiteflies of the Genus *Trialeurodes*" (U. S. D. A. Misc. Publication No. 635, pp. 85, fig. 34, ref. 9. Washington, D. C., March 1948).

Trialeurodes floridensis (Quaintance), described originally from *Psidium guajava*, occurs on many other shrub and tree hosts in southern Florida, the Bahamas, Canal Zone, Cuba and Puerto Rico, according to Miss Russell (1948–19).

Due to attack by the entomogenous fungi *Aegerita webberi*, *Aschersonia aleyrodis* and *Aschersonia flavo-citrina*, by far the most conspicuous whitefly is that on the underside of the leaves of guava (*Psidium guajava*), described by Dr. A. L. Quaintance from Puerto Rico (Technical Bull. No. 8, Division of Entomology, USDA, pp. 47–48. Washington, D. C., 1900) as *Aleurodicus* **minimus.** This has since been transferred to the genus **Metaleurodicus** (Quaintance & Baker 1913–77). The bright red, orange and yellow spore masses on top of the white mycelium of these fungi, first recorded from Puerto Rico by Dr. John R. Johnston (1915–11, 12 & 14), bulk enormous by comparison with the insignificance of the original whiteflies from which they presumably drew all of their nutrients. The same species of whitefly, as identified by Miss Louise M. Russell, occurs on guava bushes at Belém do Pará, Brasil, and is parasitized by *Aschersonia aleyrodis* Webber, as determined by Dr. Petch, who is a specialist in this group of fungi. It assumes economic importance because its attack is so wide-spread on the

whitefly, *Aleurodicus pulvinatus* (Maskell), of Brasilian rubber (*Hevea brasiliensis*) during the rainy season.

Mangrove swamps of *Laguncularia racemosa* at both Ponce and Arecibo in 1941 harbored mass infestations of what Miss Louise M. Russell identified



Colony of *Metaleurodicus minimus* (Quaintance) killed by entomogenous fungi on under surface of leaf of *Psidium guajava*, natural size. (Drawn by Fritz Maximilien.)

as a species of **Metaleurodicus,** very similar to but distinct from *M. minimus* of guava. In 1946, individual but scattered leaves of "mangle botón" (*Conocarpus erecta*) at Faro de Cabo Rojo were found infested.

Leonardius lahillei (Leonardi), the only host of which appears to be mistletoe, is a spotted whitefly whose larvae develop a mass of intermingled curved white threads. It occurs in all parts of the Island, collec-

tions having been made at Jájome Alto, Ciales, Camuy, Mayagüez, Parguera, Guánica and Yauco.

Paraleyrodes naranjae, described by Dr. H. L. Dozier as "An Undescribed White Fly Attacking Citrus in Puerto Rico" (Jour. Agr. Research, **34** (9): 853–5, fig. 3. Washington, D. C., May 1, 1927), was from the wild, sour orange or "naranja" (*Citrus aurantium*), and has not since been collected.

"**Dialeurodes citrifolii** (Morgan), the cloudy-winged whitefly", was found by Dr. H. L. Dozier (1926–121) "infesting sour-orange foliage in private home gardens at Stop 23 and in Río Piedras, the determination being confirmed by Dr. A. C. Baker. It has not so far been observed in any of the commercial groves and is undoubtedly held in check by some natural international parasite and the beneficial fungi. This species in Florida is one of the most serious pests of citrus and it is very interesting to note its lack of spreading or almost complete control on the Island." It has since been found only once, intercepted on lime at Ponce, as determined by Mr. G. B. Merrill. Despite the scarcity of records from Puerto Rico, Miss Vera K. Charles records it as attacked by the entomogenous fungi *Aegerita webberi*, *Hypocrella disjuncta*, *H. phyllogena* and *Sphaerostilbe aurantiicola*.

Dialeurodes (Gigaleurodes) buscki, described by Drs. A. L. Quaintance & A. C. Baker (Proc. U. S. National Museum, **51**: 428–9. Washington, D. C., 1917) from material collected by Mr. August Busck, is known only from the type.

Dr. A. L. Quaintance has identified as probably a new species of **Bemisia** the whitefly collected on *Euphorbia hypericifolia* at Río Piedras in 1915. Twenty-two years later, Dr. H. L. Dozier reared from this whitefly, still undescribed, an Aphelinid wasp which he named *Encarsia nigricephala*.

Citrus growers are puzzled and sometimes somewhat needlessly alarmed by finding one or more leaves of their grapefruit trees covered below by a woolly white mass consisting of numerous nymphs of the woolly whitefly, **Aleurothrixus floccosus** (Maskell) (= *A. howardi* Quaintance). Their fears are groundless, for this whitefly has been known from Puerto Rico since 1911, when it was first noted by Mr. W. V. Tower, who reported it (1911–11) also on guava (*Psidium guajava*). It has never become sufficiently abundant since to infest more than a few leaves at a time. From it, Dr. H. L. Dozier (1927–272) reared the parasitic wasp *Thysanus flavus* Girault, and (1932–116) what he described as *Eretmocerus portoricensis*, the previous record of *E. californicus* Howard being based on a misidentification. According to Miss Vera K. Charles, it has attacked by the entomogenous fungi *Aegerita webberi* and *Aschersonia aleyrodis*. Besides orange, grapefruit and Meyer lemon, it occurs on such diverse hosts as "Lignum-vitae, bananas, almácigo, canna, seagrape and many other plants" according to

Dr. Dozier. Miss Louise M. Russell identified it from seagrape (*Coccoloba uvifera*) on Mona Island.

A similar woolly whitefly on the underside of the leaves of the endemic "guayabota" (*Eugenia stahlii*) on El Yunque has been identified as a new species.

Aleurotrachelus trachoides (Back) is often sufficiently abundant on the underside of the leaves of sweet potato, Irish potato, tomato, pepper, eggplant and several species of wild *Solanum* to merit the status of a minor economic pest. Most of these host records are from Van Zwaluwenburg's list, with none of occurrence in the dryer parts of the Island.

Seagrape (*Coccoloba uvifera*) at Isabela and Quebradillas is host for an undescribed species of **Aleurotrachelus.**

Tetraleurodes ursorum Cockerell was collected by Mr. August Busck on *Coccoloba* sp., and it has since been found on seagrape at San Juan.

Tetraleurodes acaciae (Quaintance), as identified by Dr. P. W. Mason, was intercepted on "zarzabacoa" (*Meibomia supina*) at Guaynabo.

Crenidorsum leve, described by Miss Louise M. Russell proposing "A New Genus and twelve new Species of Neotropical Whiteflies (Homoptera: Aleyrodidae)" (Jour. Washington Academy of Sciences, **35** (2): 55–65, pl. 2. Washington, D. C., February 15, 1945), was found seven miles west of Ponce on "uverillo" (*Coccoloba obtusifolia*) and on St. Thomas on *Coccoloba krugii.*

Crenidorsum tuberculatum Russell (1945–57) is also from "uverillo" at Guayanilla.

Crenidorsum stigmaphylli Russell (1945–64) is from El Vigía, Ponce, on *Stigmaphyllon* or "bejuco de toro".

Aleuroplatus vinsonioides Cockerell, as identified by Miss Louise M. Russell, is very different in general appearance from the other whiteflies, the insect itself being black in color. It has repeatedly been collected at the higher elevations in Puerto Rico, on *Ocotea* sp. at Utuado, and on a possible species of *Daphnopsis* on El Yunque, the nymphs excreting five ribbons of white or yellow-green wax: the two broadest ribbons curving back, the two narrower ones forward, with a median narrower one in front.

HEMIPTERA: Bugs

Mr. H. G. Barber's treatment of the "Hemiptera-Heteroptera (excluding the Miridae and Corixidae)" (Scientific Survey of Porto Rico and the Virgin Islands, **14** (3): 263–441, fig. 36, New York Academy of Sciences. New York, July 7, 1939) is one of the most satisfactory of this series. It includes not only all collection records, but keys to all Puerto Rican species of the true bugs, redescriptions of many, and an illustration of every new species he described. For the serious student, it is indispensible. His order of species is here used.

Pentatomidae: Stink Bugs

Corimelaena minuta Uhler, a very convex black "negro bug" of the subfamily Eucoriinae (or Thyreocorinae of the family Cydnidae), whose greatly enlarged scutellum is so large as to almost entirely cover the abdomen, has "a conspicuous marginal orange-red band on the corium" according to Mr. Barber (1939–269), who lists it as of the genus *Allocoris*. Described from Cuba, and found in all the Greater Antilles, it may be much more common than the scanty records of collections in Puerto Rico would indicate. Four individuals were collected on the ground among grass and weeds, including "botoncillo" (*Borreria verticillata*), from three square feet of pasture at Pt. Cangrejos, and Messrs. Lutz and Mutchler found it at Manatí and Aibonito.

In getting ready bouquets of botoncillo flowers in Belém do Pará, Brasil, to accompany shipments of the changa parasite, *Larra americana* Saussure, to Puerto Rico, similar black bugs, *Galgupha vinculata* (Germar) and *G. schultzii* (F.), proved very persistent in clinging to the flower heads. At the time, it was thought that none had been released in Puerto Rico, but in October 1943, Prof. J. A. Ramos collected at Hatillo what he identifies as **Galgupha vinculata** (Germar).

Mr. August Busck collected at Bayamón in 1899 a single specimen of the black **Aethus communis** Uhler, but none has been found since. From numerous humid localities of coast and mountains the dark reddish-brown **Aethus indentatus** Uhler has been collected, and as an item in the food of the iguana, *Ameiva exsul*, was reported under the generic name of *Rhytidiporus*. The scutellum of these Eucoriid bugs is triangular, only moderately large, not entirely covering the abdomen. They are about 6.0 mm. long.

The slightly smaller, highly polished, black **Geocnethus reversus** was described by Messrs Barber & Bruner (Jour. Dept. Agr. P. R., 16 (3): 237. Río Piedras, October 1932) from specimens collected at Mayagüez, Isabela and Río Piedras. On November 20th, 1946, seven individuals, as identified by Dr. Reece I. Sailer, were attracted to light at Río Piedras, altho none had come to this light in the years before, or came subsequently. The collector of the paratype from Río Piedras (December 21, 1911) is not given, and no accession card of the collection at the Río Piedras Experiment Station refers to this specimen.

Geocnethus cubensis B. & B. has been collected by Prof. J. A. Ramos at Mayagüez, as determined by him, and **Geotomus spinolai** Signoret at Humacao and Fajardo.

Little rough, yellowish-brown bugs, **Amnestus pusio** Stål, less than 3.0 mm. long, of which Dr. Gundlach, under the incorrect name of *Amnesus pusillus* Uhler, notes "vuela a menudo hacia las luces encendidas en las casas", still occasionally come to light at night, and if one is tempted to

read in bed, come right thru the mosquito bar and burrow underneath one's body.

Amnestus subferrugineus Westwood is slightly larger and differently colored, all collections in Puerto Rico being from the mountains.

Amnestus diminuatus Barber (1939–274) is very similar, the type from Adjuntas.

The shield bugs (Scutellerinae) have a large convex scutellum covering most of the abdomen as do the negro bugs, but all Puerto Rican species are much larger, and often brightly colored. **Augocoris illustris** (F.) is shining dull orange in color, and apparently not as common now as when Dr. Stahl reported it under the name *Scutellera cretacea* Voet., and Dr. Gundlach as *Augocoris pallidus* H. S., altho Prof. J. A. Ramos has collections from Mayagüez, Indiera (equidistant from Lares, Maricao and Yauco), Aguas Buenas and Fajardo. A large (16.0 mm.) but dull grey specimen, collected at Belém do Pará, Brasil, was but one of many present on botoncillo. Botoncillo (*Borreria verticillata*) is not a host in Puerto Rico, the one recorded host being an ornamental euphorbia. Specimens in Cuba have been taken on the lechesillo tree, and in St. Thomas on the níspero.

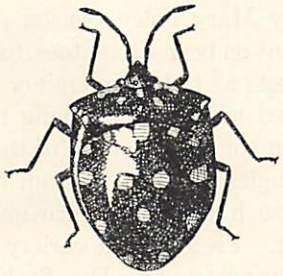
Sphyrocoris obliquus (Germar) is reported by Dr. Gundlach, and Prof. J. A. Ramos has specimens from Luquillo. Gundlach's *Mesotrypa sinuosa* Uhler MS is **Symphylus caribbeanus** Kirkaldy, since collected at Ponce and Guánica: a quaint species, grey-brown in color, with a large dark brown spot on the posterior half of the scutellum, out of which is cut an ivory white triangle behind.

Mr. Barber's new **Diolcus disjunctus** (1939–281) is what he previously reported as *D. boscii* (F.), "above closely punctate with green, each puncture rimmed with brown", but the common species is **Diolcus irroratus** (F.), yellowish or reddish brown, shining or dull, densely punctured with brown, 7.0–8.0 mm. long, also collected on Culebra and Mona Islands.

A single specimen of **Tetyra antillarum** Kirkaldy was collected at Guánica by Mr. E. G. Smyth, and subsequently it has been found at Ponce and Mayagüez.

Of **Pachycoris fabricii** L. (= *P. torridus* Scop.) Mr. E. G. Smyth took numerous photographs and wrote an article (Rev. Agr. P. R., **2** (4): 27–31, pl.2. San Juan, March 1919) entitled "Un Insecto Extraño que Cubre su Cría lo Mismo que una Gallina", describing the care taken of her eggs and just hatched young by the female. This is the most common and possibly the most striking of all the shield bugs, the nymphs being a bright iridescent green, the adults somewhat darker and velvety, spotted with orange-red, the four largest spots on the abdomen often coalescing and in a few individuals extending over nearly the entire abdomen. The normal host is wild croton (*Croton humilis* and *Croton discolor*) and *Lantana*

involucrata in arid regions, from Ponce to Hatillo and on Mona Island, but in more humid regions and in the mountains it may occur on other plants.



The iridescent green and orange-red Shield Bug, *Pachycoris fabricii* Linnaeus, twice natural size. (Drawn by Fritz Maximilien.)

Mr. Barber (1939–283) described **Megaris puertoricensis** (subfamily Megaridinae) from specimens intercepted on pomarrosa (*Eugenia jambos*) flowers by Mr. R. G. Oakley at Aibonito: a very broad, fusco-castaneous species, with the scutellum entirely covering the abdomen posteriorly, previously reported as *Megaris semiamicta* McAtee & Malloch.

Of the stink bugs (Pentatominae), the comparatively small **Mormidea cubrosa** Dallas (= *M. sordidula* Stål) and **Mormidea angustata** Stål (= *Mormidea ypsilon* L., as re-determined by Mr. Barber) have been most often found on grass and leguminous forage plants in the western end of the Island. The latter even occurs on Mona Island, its farthest east records being from Guaynabo, Río Piedras and Pt. Cangrejos.

Solubea insularis Stål (= *Mormidea guerini* L. & S.) is even less often collected than **Solubea pugnax** F., early reported by Dr. Stahl as *Pentatoma* (*Mormidea*) *typheus* F., and by Dr. Gundlach as an *Oebalus*. "The Genus **Solubea** (Heteroptera: Pentatomidae)" (Proc. Ent. Soc. Washington, **46** (5): 105–127, pl. 1. Washington, D. C., May 1944) has been discussed at length by Dr. Reece I. Sailer, and a new species described, very near to both *insularis* and *pugnax*, under the name of **ornata.** Despite its ornamental name, it is of considerable economic importance in Hispaniola, and a potential pest in Puerto Rico, because it attacks rice in the milk stage. The type is from Hormigueros, others from Cabo Rojo, together with numerous earlier records from the Dominican Republic and Haiti. In color, its "dorsum (is) dark ferrugineous with large reniform area covering each basal edge of scutellum, apex of scutellum and spot on apical fourth of corium yellow and calloused" and is somewhat less than a centimeter in length. This description applies reasonably well to all three species, the diagnostic specific characters being in the male genitalia.

Equally small for stink bugs are the common, brown densely-punctured

Euschistus bifibulus (Palisot de Beauvois) and **Euschistus crenator** (F.), the humeral angles of the pronotum sharply spined, but not so black and prolonged as in the less common **Euschistus acuminatus** Walker, illustrated in the drawing by Mary Foley Benson (Barber 1939–290). They are sometimes so abundant on beans, tomatoes, tobacco and other cultivated and wild Solanaceous hosts as to become minor pests.

Darker brown, speckled with yellow among the punctures, and with a prominent yellow spot on the posterior tip of the scutellum, **Proxys victor** (F.) has the humeral angles of the pronotum even more prolonged into sharp spines. Despite such formidable armament, Dr. Wetmore found that the ani had eaten it. Present on a variety of host plants in all parts of the Island, it was early reported by Drs. Stahl and Gundlach as *Proxys punctulatus* or *Pentatoma* (*Prionony*x) *punctata* P. de B.

Dull green, a little larger and stouter is **Thyanta perditor** (F.), and also, despite its humeral spines, eaten, according to Dr. Wetmore, by the ani, the mangrove cuckoo and the martin. It has also been found in the stomach of the dark crested lizard, and according to Miss Vera K. Charles is host of the fungus *Beauveria globulifera.* Drs. Gundlach and Stahl collected it first in Puerto Rico, Mr. August Busck at Utuado and Arroyo, and Dr. Frank E. Lutz on Mona Island. Mr. Thos. H. Jones noted both nymphs and adults in abundance on *Piriqueta cistoides.* This can hardly be the only host plant, for adults are often abundant on tomato fruits and on lima beans, as well as on garden weeds and other vegetation.

The much smaller, lighter-colored and spineless **Thyanta antiguensis** (Westwood) (= *T. taeniola* Dallas) is eaten by many more birds, Dr. Wetmore listing the ani, black swift, flycatcher, martin, mockingbird, thrush and Latimer's vireo. It was abundant on Pat McLain's ill-fated lowland rice at Canóvanas, but presumably thrives on other plants. Prof. J. A. Ramos collected a single specimen on Mona Island.

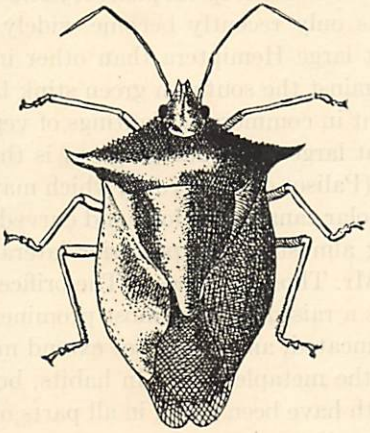
Thyanta casta Stål has a right-angled humeral spine. Mr. August Busck collected it on Vieques Island, and subsequently it has been found on many of the Virgin Islands, and less often in Puerto Rico. Prof. J. A. Ramos collected it on Caja de Muertos, off the south coast near Ponce.

Largest of all the stink bugs of Puerto Rico are the yellow-green **Loxa planifrons,** described by Messrs. H. G. Barber and S. C. Bruner (Jour. Dept. Agr. P. R., **16** (3) : 260, figs. 6 & 7, pl. 25. San Juan, October 1932) and the dark green **Loxa pilipes** Horvath (Ann. Mus. Nat. Hungary, **22:** 318, pl. 5, fig. 5. 1925), both described from Puerto Rico, both with impressive humeral spines, saw-toothed anterior margin of pronotum, but the lateral margin straight in the latter and curved in the former. Judging by the localities of collection, *planifrons* is the coastal species, *pilipes* the

mountainous one, listed by Dr. Gundlach under the MS name of *flavicollis* Drury. The nymphs are unknown, as are also the host plants.

The dark green **Fecelia minor** (Vollenhoven) was also described from Puerto Rico (Versl. Akad. Amst., Nat. II, **2**: 179. 1868), very definitely frequenting sour or sweet oranges, as is indicated by numerous interceptions made in all parts of the Island, and noted as "apparently puncturing grapefruit at Las Marías".

The red, conspicuously marked by black **Rubinia perspicua** (F.) has been found on Vieques Island, according to the determination by Mr. Barber of a specimen in the AMC (Mayagüez College) collection, dated xii–35.



Loxa variegata Distant, an Hispaniolan Pentatomid, not known to occur in Puerto Rico, twice natural size. (Drawn by Fritz Maximilien.)

A single specimen of the purple **Vulsirea violacea** (F.) was collected at Ponce by Mr. R. G. Oakley, the only record from Puerto Rico, altho Mr. Barber reports its occurrence "in a number of the West Indian Islands".

The brilliant bluish-green **Pharypia pulchella** (Drury), red-headed and with lateral crimson bands across pronotum and corium, has been quite often collected in the western part of Puerto Rico, and once at Río Piedras.

Of all the Pentatomidae, the southern green stink bug or "pumpkin bug" **Nezara viridula** (L.), is the only one which is often a serious pest, sometimes occurring in large numbers on such vegetables as tomatoes, lima beans and pigeon peas. It may even attack tobacco, extracting so much cell sap that the top of the plant droops. Its early occurrence is attested by the record by Dr. Stahl under the name *Pentatoma smaragdula* F. Dr. Wetmore notes it as an item of food for the ani, kingbird, petchary, flycatcher and a

vireo, and it is also eaten by *Bufo marinus*. The eggs of the Tachinid fly parasite, *Trichopoda pennipes* F., are sometimes seen on the back of the pumpkin bug. This Dipterous parasite is not especially abundant, and as it also oviposits on many other large bugs, it can hardly be considered an especially effective agent in control. The nymphs of the green plant bug are gaily colored and marked, often being accompanied by one or more adults. Hand collection of the nymphs into a bottle partly filled with kerosene and water is a practical method of control for the small-scale vegetable grower, but he needs to be active, or use a net, if the adults are to be caught before they escape by flight. Sabadilla, a powder obtained from the seeds of *Schoenocaulon officinale* of Venezuela, and Ryania, a dust containing the ground stems of the tropical plant *Ryania speciosa*, of which the toxicity to insects has only recently become widely known, are possibly more effective against large Hemiptera than other insecticides, and their use, or of chlordan, against the southern green stink bug is indicated when these become abundant in commercial plantings of vegetables.

Averaging somewhat larger, and darker green is the less common **Acrosternum marginatum** (Palisot de Beauvois), which may be distinguished by "the orifice of the osteolar canal being long and curved, becoming gradually evanescent, extending almost to the posterior lateral angle of the metapleura" according to Mr. Thos. H. Jones. The orifice of the osteolar canal of *Nezara viridula* has a raised margin, most prominent towards the apex, where it is sharply truncated, and "does not extend more than half way to the lateral margin of the metapleura". In habits, both these green plant bugs are alike, and both have been found in all parts of Puerto Rico and on Vieques and Mona Islands.

Banasa herbacea, described by Stål as a *Piezodorus* from St. Thomas, Virgin Islands, had been collected on Vieques by Dr. M. D. Leonard and at Santurce; by Lutz & Mutchler at Ensenada and by Prof. J. A. Ramos in the Guánica Forest.

Banasa humeralis, described by Mr. H. G. Barber (1939–297) from San Germán, is a shining olive-green. Prof. J. A. Ramos has specimens from Mayagüez, Añasco and Luquillo.

Beans and cowpeas are often infested with the small, light green **Piezodorus guildinii** (Westwood), a common and widely distributed little plant bug, found thruout the neotropics. **Piezodorus tinctus** Distant, listed by Dr. Stahl, has been found only once since, at Aibonito.

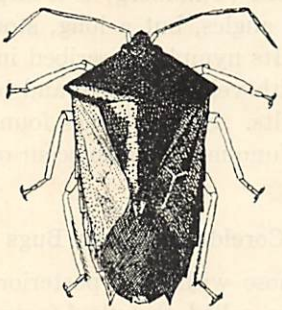
Arvelius albopunctatus (DeGeer), dull greenish yellow, spotted with white on the corium, has black spots on the pronotum and scutellum. Despite sharp humeral spines, the iguana (*Ameiva exsul*) ate this minor pest of tomatoes, eggplant and peppers. Its original host is presumably *Solanum torvum*, on which it is still often found, having been listed by

Drs. Stahl and Gundlach. When a small garden was started on Mona Island, this bug promptly appeared feeding on young eggplants.

Andrallus spinidens (F.) was collected once in flight in a cane field at Guánica by Dr. Luis F. Martorell.

Brepholoxa rotundifrons, described by Mr. H. G. Barber (1939–300) from specimens from Haiti, Ensenada, P. R. and Anegada of the Virgin Islands, is just a centimeter long, "uniformly pale testaceous yellow; lateral margins of head and pronotum, at least anteriorly, ferruginous-tinted". Mr. J. A. Ramos collected one specimen on Mona Island.

The bluntly rounded humeral angle of the green prothorax, the heart-shaped white spot at the tip of the green scutellum, and brown wings should identify **Edessa cornuta** Burmeister (= *E. bifida* Gundlach), 11.0–12.0 mm. long. Mr. E. G. Smyth repeatedly collected eggs, nymphs and adults at Río Piedras on wild morning-glory (*Ipomoea rubra*) and presumably this is the normal host, altho adults have been found resting on numerous other plants in all the more humid parts of the Island. The Plant Quarantine Inspectors intercepted it in citrus groves at Bayamón, Barceloneta and Adjuntas. It was listed by Dr. Stahl as *Aceratodes*, and by Dr. Gundlach under Say's MS name of *bifida*. Dr. Wetmore found it eaten by the ani, and it also serves as an item of food for the crested lizard.



Edessa paravinula Barber. Four times natural size. (Drawn by G. N. Wolcott.)

In the mountainous coffee groves, usually on coffee, but also on citrus, and most commonly at Indiera (equidistant from Lares, Maricao and Yauco) with both adults and nymphs on *Solanum torvum*, is found what was first called *Edessa vinula* Stal or *Edessa affinis* Dallas. Eventually it was described by Mr. H. G. Barber as **Edessa paravinula** (Amer. Mus. Novitates No. 786, pp. 3. New York, March 30, 1935); mostly dark green, with iridescent brownish wings, the veins of the corium being outlined in ivory white or cream.

Alcaeorrhynchus phymatophorus Palisot de Beauvois (of which Mr. Otto Heidemann identified specimens for Mr. R. H. Van Zwaluwenburg

as *Mutyca grandis* Dallas, and Mr. W. L. McAtee later gave the same name), was first collected by Dr. Gundlach in Puerto Rico. It has since been found at Yabucoa, Caguas and Cayey, the only host record being on "palo verde" (*Parkinsonia aculeata*) at Faro de Cabo Rojo.

Of **Podisus sagitta** (F.), "the humeral angle is bifid, with the anterior prong longest and directed outwards" according to Mr. Barber, and the curved posterior end of the scutellum is cream-colored, or at least much lighter in color than the rest of this brownish bug. Twice noticed in cotton fields, in one case it was observed in the act of feeding on the juice of the cotton caterpillar, *Alabama argillacea* Hübner. Mrs. Dexter found it in the stomach of *Bufo marinus*, and Prof. J. A. Ramos collected one specimen on Mona Island.

Podisus mucronatus Uhler, another brown bug with two conspicuous, calloused, yellow spots on the anterior disc of the pronotum, and other similar areas elsewhere, has been collected in cane fields at Guánica and Coloso.

The type of **Podisus borinquensis** Barber (1939–305) was intercepted by Mr. R. G. Oakley at Ponce; its paratype collected by Dr. Richard T. Cotton on coffee leaves at Río Piedras. It was previously recorded under the name of *Podisus sculptus* Distant.

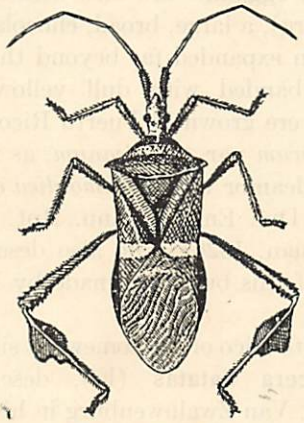
Piezosternum subulatum (Thunberg) is a large, dull, dark green stink bug with blunt humeral angles, but a long, stout spine on the posterior angle of the scutellum. Its nymphs, described in "Insectae Portoricensis" (1923–254) are bright with yellow, orange and black, often noted accompanying an adult or adults. Several times found on coffee in the mountains, or in flight on El Yunque, they also occur on a variety of hosts along the coast.

Coreidae: Squash Bugs

Of all the Coreidae, those with their posterior tibiae flattened and expanded, so that they are called the "leaf-footed" plant bugs, are most striking in appearance. **Leptoglossus gonagra** (F.) is entirely dark brown in color, and has been charged by Plant Quarantine Inspectors Richard Faxon and C. P. Trotter (Jour. Ec. Ent., **25** (3): 446. Geneva, June 1932) with "damaging oranges and grapefruit by puncturing the fruit and extracting the juice, causing a corky area beneath the peel." These bugs occur in all of the more humid sections of the Island, having been noted by Dr. Gundlach, and as *Anisoscelis* listed by Dr. Stahl. Dr. Richard T. Cotton, discussing them as a pest of squashes, notes (Jour. Dept. Agr. P. R., **2** (4): 307. San Juan, October 1918) that the female "lays small, brown, barrel-shaped eggs in a single row on the stems of the vine. These hatch into small, bright red and black wingless nymphs that suck the

juices from the leaves and stems in a manner similar to the adult. These nymphs pass through a number of form and color changes before becoming adults." The adults have also been noted on pumpkins and corn, and resting on other plants, while both nymphs and adults were found feeding on the fruits of the guava (*Psidium guajava*) at Mayagüez, Peñuelas and Arecibo.

Leptoglossus stigma (Herbst) has a distinct yellow band across the corium, the leaf-expansion of its hind tibiae is large, thin and usually with three teeth. Very definitely, its normal host is guava fruits, altho it also has been found on "achiote" (*Bixa orellana*). It is listed by Drs. Gundlach and Stahl, the latter using the name *Anisoscelis serrulatus* H. S.



Leptoglossus cinctus H. S., an Hispaniolan Coreid, not known to occur in Puerto Rico, twice natural size. (Drawn by Fritz Maximilien.)

Leptoglossus balteatus (L.), a less common species with only two teeth in its hind tibial flattening, found in more xerophytic regions, also feeds on guava (*Psidium guajava*).

The bright red nymphs of **Phthia picta** (Drury) and the dark brown adults, usually with a transverse yellow or orange band across the pronotum, congregate in groups on young tomato fruits. Their feeding punctures persist in mature fruits as cores of corky tissue, and the entire fruit is puckered and distorted. Before tomatoes were cultivated in Puerto Rico, these bugs fed on *Solanum nigrum* var. *americanum* fruits, as noted by Mr. Thos. H. Jones (1915–4), and they may also at times feed on melons, pumpkins or cucumbers. Listed by Dr. Gundlach and collected by Mr. August Busck on Vieques, in the garden of the Forest Service on Mona Island they attacked eggplant. As each tomato fruit upon which they feed is ruined for marketing, it is well worth while to hand collect these bugs with a net

and kill them in a bottle of kerosene, if they become at all abundant, for none of the ordinary insecticidal or fungicidal sprays or dusts used on tomatoes has the least effect on them. For extensive plantations, the use of chlordan or of sabadilla or ryania is indicated, the new insecticides which can be used successfully against all these larger bugs.

Mr. H. G. Barber (1939–312) considers the records of *Phthia lunata* F. by Drs. Stahl and Gundlach and in his own preliminary list to refer to **Phthia rubropicta** (Westwood), the West Indian species which has a shining steel-blue head and pronotum, and markings of orange-red. It is quite common at Mayagüez, and has been collected at Utuado, Jayuya, Villalba, Adjuntas and Yabucoa.

Tomatoes, pepper and eggplant are also attacked by **Spartocera** (or *Corecoris*) **fusca** (Thunberg), a large, broad, chocolate brown bug with the thin edges of its abdomen expanded far beyond the margins of its folded wings, and alternately banded with dull yellow and brown. Before Solanaceous vegetables were grown in Puerto Rico, it presumably fed on the fruits of *Solanum nigrum* var. *americanum*, as it sometimes still does, and on those of the cundeamor vine (*Momordica charantia*), as noted by Dr. H. L. Dozier (Rpt. Div. Ent., *in* Ann. Rpt. Insular Expt. Station, 1924–25, p. 116. San Juan, 1926), who also describes the early stages. The earliest collections of this bug were made by Dr. Gundlach and Mr. August Busck.

The first record in Puerto Rico of the somewhat similar, but entirely dull chocolate-brown **Spartocera batatas** (F.), described originally from Surinam, is by Mr. R. H. Van Zwaluwenburg in his 1914 typewritten list, giving as host sweet potatoes. Both Mr. Thos. H. Jones and Dr. R. T. Cotton subsequently reported it as a serious pest on sweet potatoes, and Dr. M. D. Leonard on Irish potatoes at Utuado. Dr. Dozier (1926–116), in addition to life history notes, records its parasitization by *Trichopoda pennipes* F., and destruction by the fungus *Sporotrichum gleosporoides*, which is *Beauveria globulifera* according to Miss Charles. Dr. Wetmore found these big bugs eaten by the ani and vireo, and they also form an item of food for the crested lizard. Clusters of its dull golden eggs were found in abundance on the trunks of bucare trees at Cayey by Dr. Cotton, and have repeatedly been noted on fence posts elsewhere. The freshly hatched nymphs are bright red in color, but in later instars become marked with brown, and at last are entirely dull brown except for the head and protruding angles of the pronotum and segments of the abdomen. Ryania powder will kill the adults, but, surprisingly enough, not the nymphs.

The largest of all the squash bugs in Puerto Rico is **Sephina erythromelaena** (White), velvety black and crimson, of which the adults found at Indiera, June 16, 1921, when that region had first been made accessible by

roads from Lares, Maricao and Yauco, were on a parasitic vine, *Metastelma* sp. Described originally from Brasil, the Puerto Rican specimens were described under the specific name of *indierae* ("Insectae Portoricensis" (1923–251), Mr. H. G. Barber (1939–316) pointing out their identity with those from Perú and British Guiana.

Dr. Gundlach first collected in Puerto Rico the slender brown **Chariesterus gracilicornis** Stål (= *C. moestus*), which has since been taken, or at least found resting on a wide variety of host plants in all parts of the Island. Despite sharply spined humeral angles, it is eaten by the little grass lizard, *Anolis pulchellus*.

Prof. J. A. Ramos has specimens of **Althos obscurator** (F.) from Lares, Maricao and Maricao Forest, and Mr. H. G. Barber (1939–318) corrects the record of the one from Aibonito as a *Margus* in his preliminary list (1923–12).

Mr. August Busck collected on Vieques Island the slender yellowish-brown **Catorhintha guttula** (F.), densely punctured with brown, more especially characterized by a prominent spine on the outer angle of the antenniferous tubercle. It has since been collected on Mona Island, feeding on corn leaves, and at many localities in Puerto Rico on a variety of hosts. On the south coast it is especially abundant on the sticky-capsule vine, *Commicarpus scandens*. Dr. Wetmore found it in the stomach of the ani.

Mr. H. G. Barber (1939–319) has described **Catorhintha borinquensis** from a specimen collected at Coamo Springs, and other specimens have since been intercepted at Aibonito and Villalba by Mr. R. G. Oakley.

Anasa scorbutica (F.) is a broader, darker bug, the median dorsal part of its abdomen being bright chestnut in color, and the outwardly curving spine of the antenniferous tubercle prominent. Altho elsewhere a pest of curcurbits, it is hardly that in Puerto Rico, the record of greatest abundance being in a cane field at Fajardo.

Zicca taeniola (Dallas), dull yellow with ivory tipped scutellum and spot on corium, sharp humeral angles, listed by Dr. Gundlach and in Van Zwaluwenburg's list, is an inconspicuous little bug that Mr. E. G. Smyth found on curcurbits at Añasco, and in great abundance on the seed heads of the weed blero (or "bledo") at Guánica. Presumably this last record indicates the normal host: *Amaranthus*, checking with interception at Cidra on cockscomb.

By far the most beautiful and quite the most interesting of all Coreids is **Sphictyrtus whitei** (Guérin-Méneville). Crimson, black and iridescent green above, the abdomen yellow or orange in color, the adults swarm at times in such abundance on Mona Island as to bend down the branches of trees on which they cluster. Described originally from Cuba, where it is

rare, and in addition known only from a single "specimen in the United States National Museum collection labeled San Salvador, Bahamas (Bartsch)" according to Mr. Barber (1939–321), it has never been found in Hispaniola or Puerto Rico, or even on Desecheo. Despite the usual abundance of adults on Mona Island, neither eggs nor nymphs have been discovered, and the clusters of adults are not feeding on the plants on which they are resting. Mr. Francisco Seín thought that they might be feeding on corn when he visited Mona in 1926, but since beefwood trees (*Casuarina equisetifolia*) have been planted in the level sandy region along the west coast, these introduced Australian trees have been preferred for clustering upon. Close to Camp Kofresí, those most heavily infested with cottony cushion scale have greatest numbers of these bugs, disputing with paper-nest wasps, *Polistes crinitus* Felton and *Polistes major* P. de B., and invariably retreating and flying off with a loud buzzing sound to land on another branch of the same tree. In September 1944, they were comparatively scarce, and Prof. J. A. Ramos did not observe them in April 1935, but these are the only times that visiting entomologists have failed to find them in overwhelming abundance on Mona.

Dr. Frank E. Lutz collected a single specimen of **Hyalmenus longispinus** Stål on Mona Island when he was there in February 1914.

The slender **Megalotomus rufipes** (Westwood), listed by Dr. Gundlach as *Alydus pallescens* Stål, is quite common on leguminous crops and weeds. Its spiny hind legs did not prevent its being eaten by the little grass lizard, *Anolis pulchellus*.

The longest and most slender of the squash bugs found in Puerto Rico, and most untypical, is **Leptocorisa filiformis** (F.), first collected here by Dr. Gundlach, and subsequently in all parts of the Island, often on sugar-cane, and most recently on Mona Island by Dr. Luis F. Martorell.

Harmostes serratus (F.) was intercepted on dahlia at Cidra, and several times elsewhere on the Island, without host record. Mr. Harold E. Box collected **Harmostes affinis** Dallas at Aguirre. Mr. H. G. Barber himself collected **Xenogenus extensum** Distant at San Juan.

Liorhyssus hyalinus (F.), previously reported from Puerto Rico as a *Corizus*, is also most untypical of the squash bugs: a little, bright-colored insect with hyaline wings, common on Solanaceous vegetables and weeds in all parts of the Island, as well as on Vieques and Mona. The little grass lizard eats it, and also eats **Niesthrea vincentii** (Westwood). The latter, listed by Dr. Gundlach and more recently as *Corizus sidae*, occurs in all parts of Puerto Rico, and on Mona, Desecheo (Lutz), Vieques and Culebra (Busck), but shows no exclusive host preferences, having been found in abundance on bledo flower-heads, on malva (*Malachra alceifolia*) fruits,

and at Boquerón in all stages in great abundance on *Waltheria americana*. The eggs and nymphs are described in "Insectae Portoricensis" (1923–249.)

Mr. H. G. Barber considers his **Jadera rufofusca** (1939–328) as the only species of this genus occurring in Puerto Rico, despite all the other names listed, including *Serinetha coturnix* Burmeister, which Dr. Gundlach gave in synonymy. With pinkish head and body and light brown wings and legs, the shape suggests that of the cotton-stainers, but the ocelli are large and prominent, and the adults show a surprising indifference to living vegetation. Hundreds were noted at Guánica resting on the shady side of a dry fence post, and they often come to light in numbers. Mr. R. G. Oakley intercepted them on "úcar" and on the sedge "junco" at Ponce. Most recently nymphs were found at Barceloneta on *Serjania polyphylla*.

The continental **Jadera haematoloma** Herrich-Schaeffer, previously known only from Cuba in the West Indies, was found in abundance, both nymphs and adults, "under dead leaves and on the dry culms of guinea grass" on Mona Island by Prof. J. A. Ramos (1947–30). It is red and black in color, with a conspicuous median carina on the pronotum.

Aradidae: Flat Bugs

Of the flat bugs, the two Puerto Rican records given by Mr. H. G. Barber (1939–330) for the rather large black **Mezira abdominalis** (Stål) are of collection at Mayagüez (Landrón) and of listing without locality by Bergroth.

Eretmocoris tatei, described by H. M. Harris and C. J. Drake as one of "New Apterous Aradidae from the Western Hemisphere (Hemiptera)" (Proc. Ent. Soc. Washington, **46** (5): 128–132. Washington, D. C., May 1944), is from a single male collected at Lares, "small (length 3.4 mm., width, 1.55 mm.), reddish brown, oblong-ovate", both head and thorax ridged, the "antenniferous tubercles very prominent".

Drs. Donald De Leon and L. F. Martorell found beneath the moist bark of a "corcho" (*Pisonia subcordata*) tree at Camp Buena Vista at Maricao, the oval grey eggs, the light brown nymphs and the darker adults of what Mr. H. G. Barber identified as **Aneurus** sp., near *minutus* Bergroth. Mr. Barber's preliminary list gives *Aneurus politus* Say for specimens collected in decaying wood at Adjuntas which are re-described in his final paper (1939–330) under the name **Aneurus minutus** Bergroth.

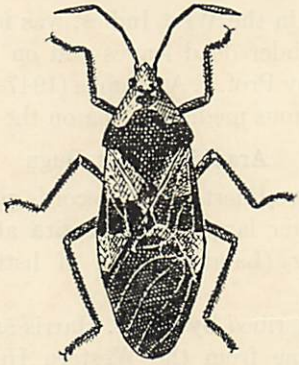
Neididae

Mr. H. G. Barber (1939–331) describes **Jalysus reductus** from a single type collected on Mona Island by Dr. Frank E. Lutz, and many paratypes from Trinidad, Cuba, Hispaniola, Mexico and Panama. A very slender bug, it has extraordinarily long legs and antennae.

Lygaeidae: Chinch Bugs

Possibly the least typical of the chinch bugs is the large orange-red and black milkweed bug, **Oncopeltus fasciatus** (Dallas), common everywhere in Puerto Rico, on Mona and Culebra Islands on *Asclepias curassavica*. It is often attracted to lights, but quite consistently feeds only on milkweed.

Oncopeltus aulicus (F.), crimson and black, with a white spot like a drop of milkweed juice on the wings, is apparently comparatively rare in Puerto Rico, the only collection authoritatively determined being that by Dr. W. A. Hoffman at San Juan. In 1899 Mr. August Busck found it on Vieques Island, and Dr. Luis F. Martorell collected it in abundance on Mona Island on the flowers of "abeyuelo" (*Colubrina ferruginosa*), and fewer on the flowers of "corcho" (*Pisonia albida*) and *Moringa oleifera*.



The Milkweed Bug, *Oncopeltus fasciatus* (Dallas) three times natural size. (Drawn by Fritz Maximilien.)

The very similar but more extensively black **Oncopeltus semilimbatus** Stål also occurs on Mona Island, most recently noted on castor bean (*Ricinus communis*), but not at all in Puerto Rico.

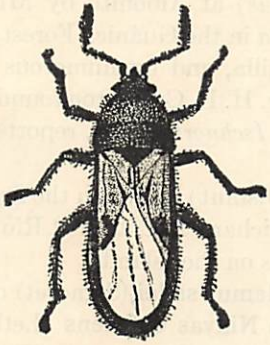
Lygaeus (Craspeduchus) pulchellus F., a little black bug neatly and evenly margined in pale yellow, the lateral margins of pronotum red, was described by Fabricius from St. Croix (1794), and its name remains unchanged to date. It occurs in the other Virgin Islands, and Dr. W. A. Hoffman found it on Mona, and specimens collected by Mr. R. H. Van Zwaluwenburg are from Añasco. Dr. Richard T. Cotton found adults in abundance mating on *Corchorus hirsutus* at Pt. Cangrejos, February 20th, 1916. More recently, April 5, 1944, they were present in abundance on this host at the airport on Mona Island, but not mating.

The posterior two-thirds of the pronotum of **Lygaeus (Ochrimus) collaris** F. is red; another bug retaining the original name given it in 1803, the type from St. Thomas. Often coming to light at many points in

Puerto Rico, the only record of mating is for January 20th, 1940 at Aguadilla. Dr. Luis F. Martorell found it abundant on "corcho" (*Pisonia albida*) on Mona Island, the only record of a host plant.

Mr. H. G. Barber described **Lygaeus (Melanocoryphus) albonotatus** (1939–337) from a single specimen from Mona Island, and **Lygaeus coccineus** (1939–339) from collections made by Dr. Frank E. Lutz at San Juan.

The little grey **Ortholomus jamaicensis** (Dallas) was earliest collected by Mr. August Busck on Vieques Island, but it is common in Puerto Rico. The earliest host record is by Mr. Thos. H. Jones, who found all stages abundant on *Hyptis pectinata*, but later collections have been made on milkweed.



The Chinch Bug, *Blissus leucopterus* Say. Fifteen times natural size. (After Webster.)

The chinch bug, **Blissus leucopterus** (Say) var. **insularis** Barber, is sometimes a major pest of guinea grass in the region west of Arecibo, and has been observed to kill out extensive patches of malojillo at Manatí during extreme dry weather. The introduced Java grass, *Polytrias amaura*, is especially susceptible to attack, even in normally humid regions. Rice and corn are more rarely attacked, and instances of infestation on sugarcane are rare. One sometimes sees a few adults on young cane during dry weather, but these are mostly migrants from surrounding grassy margins. The chinch bug occurs on Vieques and Mona Islands, as well as in northern Puerto Rico, but hardly at all on the xerophytic south coast. All of the smaller lizards eat the chinch bug, and it constitutes 10 per cent of the normal food of the little grass lizard, *Anolis pulchellus*, at Río Piedras. Obviously, these little lizards are an important factor in control, and possibly one reason why outbreaks occur in the northwestern part of the Island is the relative scarcity of lizards in pastures and cultivated guinea grass fields there.

Nysius basalis Dallas (= *inaequalis* Uhler), **Nysius tenellus** Barber 1947 (= *strigosus* Uhler), and **Nysius ericae** (Schilling) (prob. = *N. scutellatus* Dallas) have all been collected on Mona Island repeatedly, as well as in Puerto Rico, the first, "pale testaceous, punctate with brown", also on Desecheo by Mr. H. E. Crampton. The latter is common in the States, being a rather serious pest, called the false chinch bug, but in Puerto Rico it is known only from the mountains, at Caguas and Adjuntas. *Nysius strigosus* was found by Mr. A. S. Mills on *Pluchea purpurascens* at Pt. Cangrejos.

Pluchea purpurascens also proved to be host for **Cymus virescens** (F.), which Mr. R. G. Oakley intercepted on mangrove at Ponce.

The very small **Kleidocerys championi** (Distant) was collected on "fresas" (*Rubus rosaefolius*) at Aibonito by Mr. Oakley, by Prof. J. A. Ramos on *Sauvagesia erecta* in the Guánica Forest, by Dr. Luis F. Martorell on sugar-cane at Guayanilla, and by numerous other collectors in other parts of Puerto Rico. Mr. H. E. Crampton found it on Mona Island, where Prof. J. A. Ramos, as an *Ischnorhynchus*, reports it (1947–26) as "exceedingly abundant".

Cymoninus notabilis (Distant), of which the first record in Puerto Rico is swept from grass by Dr. Richard T. Cotton at Río Piedras, has subsequently been found at many points on the Island.

The little black **Ischnodemus sallei** (Signoret) occurs in the mountains of Puerto Rico, as does also **Ninyas deficiens** (Lethierry).

A single **Geocoris thoracicus** (Fieber) Dr. Wetmore found eaten by the tody. It is a small black Lygaeid occurring in the most xerophytic part of the Island. Prof. J. A. Ramos collected specimens at Faro de Cabo Rojo, and also on Mona Island.

Pachygrontha bimaculata Distant is common on weeds in the spring at Mayagüez according to Prof. J. A. Ramos. Mr. H. G. Barber (1939–348) described the much smaller (4.5 mm. long) **Pachygrontha parvula** from Mona Island.

Mr. August Busck in 1899 collected the single specimen of **Ligyrocoris litigiosa** (Ståhl) known from Puerto Rico, and Mr. H. G. Barber in 1914 the only specimen of **Ligyrocoris abdominalis** (Guérin-Méneville), at Ponce.

Paromius longulus (Dallas), first recorded from Puerto Rico under the name *Pamera*, is a very elongate dark little bug which has been collected generally in grapefruit groves in Puerto Rico: on weeds or crotalaria, and has also been found on Desecheo and Mona Islands.

Under the name *Orthaea ferruginosa*, Mr. H. G. Barber listed (1923–4) what he subsequently (1924–136) renamed **Pachybrachius intermedius,**

of which specimens have been collected at Cataño, Isabela, Mayagüez, Maricao and Adjuntas. It also occurs in Hispaniola and Cuba.

Pachybrachius vinctus (Say) appears to be the common species of the genus, first reported from Puerto Rico by Dr. Gundlach as a *Pamera*, and later reported as an *Orthaea* from all parts of the Island. It also occurs on Mona and Vieques Islands. It was this species of which Mr. Thos. H. Jones found nymphs feeding on *Piriqueta cistoides*, altho adults have been noted on many other hosts. All the smaller lizards eat these bugs in considerable numbers: the records being lumped under the name of *Orthaea bilobata*. **Pachybrachius bilobatus** (Say) is somewhat larger than the others, and almost as common as *vinctus*. **Pachybrachius servillei** (Guérin-Méneville) is comparatively rare in Puerto Rico. Prof. J. A. Ramos collected **Pachybrachius scutellatus** (Dallas) at Mayagüez, and specimens from Mona Island were thus identified by Mr. H. G. Barber.

Heraeus guttatus (Dallas), of which a single specimen was collected at light at Isabela by Dr. M. D. Leonard, has been found by Prof. J. A. Ramos on Mona Island.

Exptochiomera minima (Guérin-Méneville) has been found at Aguirre, Ensenada, San Germán and Adjuntas.

Ozophora burmeisterii (Guérin-Méneville) and **Ozophora pallescens** (Distant), judging by the number of collections, are the least abundant of this genus in Puerto Rico. The three new species described and illustrated by Mr. H. G. Barber (1939–356 to 360): **atropicta, subimpicta** and **quinquemaculata** are the more common, the latter especially on Vieques Island, and *atropicta* on Mona and Andros Islands, and in Hispaniola. Prof. J. A. Ramos has described in "The Insects of Mona Island, West Indies" (Jour. Agr. Univ. P. R., **30** (1): 1–74, pl. 2., ref. 45. Río Piedras, December 31, 1947) **Ozophora octomaculata** from Mona Island, "readily distinguished by the eight conspicuous yellowish-orange spots on the pronotum", of which his illustration is reproduced on page 139.

Paragonatas divergens (Distant), first collected in Puerto Rico by Mr. Francisco Seín at Lares, has since been taken by Prof. J. A. Ramos at Mayagüez, and by him also on Mona Island.

Of **Clerada apicornis** Signoret, Dr. Gundlach noted "se encuentra en toda la isla", but recent collections have all been made in the western end of Puerto Rico, despite its cosmopolitan world distribution.

Pyrrhocoridae: Cotton-Stainers

The plumpest of the cotton-stainer bugs is **Largus obovatus,** described as a *Euryophthalmus* by Mr. H. G. Barber (1923–5) from Hispaniola and Puerto Rico. It is mostly blue-black in color, with the front margin of the

wings and the rear of the pronotum bright red. It has been found most often on coffee, or coffee shade-trees in the mountains, as well as on wild orange and on bromeliads on bucares. Despite the reputation of cotton-stainers being avoided by predaceous animals because of warning colors indicating unpleasant odor or taste, one of these plump and juicy bugs was found to have formed an item of food for the crested lizard.

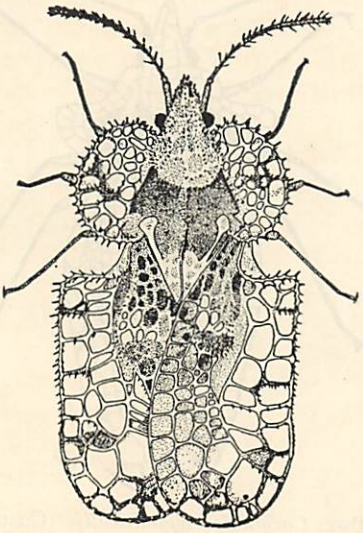
The somewhat larger and more brightly colored cotton-stainer, **Dysdercus sanguinarius** Stål (= *D. neglectus* Uhler & *D. jamaicensis* Walker), which may be distinguished by the pale posterior margin of the pronotum, is not very common, and is only a minor pest of cotton. It has been found on the fruit of *Sterculia apetala* at Mayagüez, and Mr. L. Courtney Fife, reporting on his three year's observations on the "Insects and a Mite found on Cotton in Puerto Rico, with Notes on their Economic Importance and Natural Enemies" (P. R. Agr. Expt. Station Bulletin No. 39, pp. 14, ref. 45. Washington, D. C., March 1939) found it "numerous on maga (*Montezuma speciosissima*) and to a lesser extent on clamor (*Thespesia populnea*)."

The common cotton-stainer in Puerto Rico, present also on Mona and Culebra Islands, is **Dysdercus andreae** (L.), first reported from the Island by Mr. O. W. Barrett (1905–396) as *Dysdercus suturellus* Herrich-Schaeffer, a species which is not found here. It is by no means so numerous or so serious a pest in Puerto Rico as in Hispaniola, or in the cotton-growing Lesser Antilles, but it sometimes becomes locally abundant towards the end of the cotton picking season. Mr. Fife (1939–8) counted 20 per cent of all bolls injured, principally by this species, and considers "the staining and discoloration of the lint caused by the boll-feeding habits of various species of hemipterous insects materially reduces the grade of the entire crop, and, therefore, its value". Both adults and nymphs feed on the juice of cotton seeds, preferably attacking those most nearly mature or in the bolls that opened ahead of the majority in the field, but when cotton seed is not available, they are often found on those of the "ceiba" (*Ceiba pentandra*), and of the endemic "maga" (*Montezuma speciosissima*). Mr. Fife noted that "the most favorable host of *D. andreae* is *Thespesia populnea*, on which it may be found during the entire year; *Abutilon hirtum* and *Sida* sp. also serve as hosts".

Tingidae: Lace Bugs

The specific name of the most common of the lace bugs in Puerto Rico, **Corythucha gossypii** (F.), was doubtless correct for the particular specimens described, for it is still found, rarely, on cotton. Mr. L. Courtney Fife (1939–9) mentions it as a pest of cotton, but considers the damage caused to be negligible. The normal hosts are lima bean, sword bean and

castor bean, and to a much lesser extent, such unrelated plants as Meyer lemon (*Citrus excelsa* var. *davaoensis*), orange, grapefruit, soursop, breadfruit, yautía and papaya. As observed by Dr. Luis F. Martorell, such forest trees as "aceitillo" (*Zanthoxylum flavum*), "carubio" (*Zanthoxylum monophyllum*), "espino rubial" (*Zanthoxylum caribaeum*), "sapo" (*Capparis baducca*) and especially *Isandrina emarginata*, may have their leaves so heavily infested that they turn yellow and drop. Common everywhere in Puerto Rico, it has been noted on *Ichthyomethia* (or *Piscidia*) *piscipula* and castor bean on Vieques Island, and on the latter host on Mona. Prof. J. A. Ramos found it on "palinguán" (*Capparis flexuosa*) on

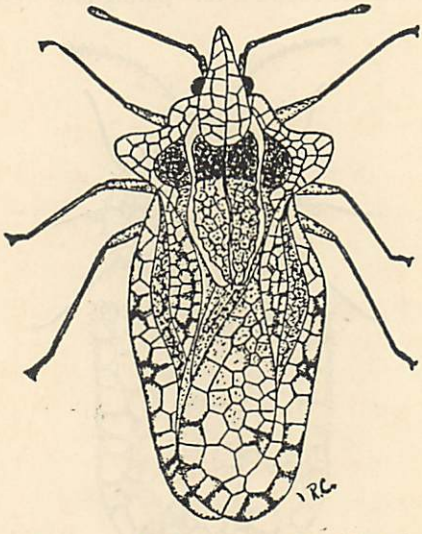


The Bean Lace Bug, *Corythucha gossypii* (Fabricius), twenty times natural size. (Drawn by Francisco Seín.)

Mona Island. "Observations on the Bean Lace Bug in Porto Rico" (Jour. Dept. Agr. P. R., 15 (3): 309–323, fig. 1, pl. 2, ref. 44. San Juan, September 1931) by Dr. M. D. Leonard and Mr. A. S. Mills give its life-history in detail.

The eggplant lace bug, another broad, light-colored species, **Corythaica cyanthicollis** (Costa) (= *C. planaris* Uhler, not *C. monacha* Stål, which is exclusively South American) is a very serious pest of eggplant, and all the more difficult to control because of constant re-infestation from wild eggplant, *Solanum torvum*. Exceptionally it may occur on tobacco, tomato and cabbage. The poorest farmer may save his eggplants during dry weather, however, for common laundry soap, 1 to 100, will kill both nymphs and adults. On larger plantations, much greater dilutions of pyrethrum

and rotenone have been used successfully, but it is against such insects as these which have no parasites or predators, and live on parts of the plant not used as food by domestic animals or human beings, that DDT and gamma isomer of benzene hexachloride can be used most effectively. All of the lace bugs become abundant during dry weather, and their populations sink to insignificant numbers during wet weather, possibly in part due to attack by the entomogenous fungus, *Acrostalagmus aphidum*. The little grass lizard eats these bugs, but not in large numbers. The best and most extensive account of "The Egg-plant Lace-Bug in Porto Rico" was written



The Eggplant Lace Bug, *Corythaica cyanthicollis* (Costa), twenty times natural size. (Drawn by R. T. Cotton.)

by Dr. R. T. Cotton (Jour. Dept. Agr. P. R., 1 (3): 170–3. San Juan, July 1917).

Corythaica carinata Uhler is a much less common and more elongate species, also found on eggplant, and, as determined by Dr. H. L. Dozier, on *Urena lobata* at Dorado.

Yatiga illudens (Drake), earlier reported as a *Leptopharsa*, and by Mr. H. G. Barber described (1923–6) under the name *Atheas pallidus*, a very delicate-looking, elogate, waxy-white species, is a minor pest of yuca (*Manihot* sp.).

The type of **Leptodictya bambusae** Drake was from bamboo at Mayagüez (Ohio Jour. Science, 18 (5): 175. March 1918) and is rather abundant there.

Teleonemia sacchari (F.), large, dark, and elongate, has nothing to do

with sugar-cane, so far as known. Its hosts, as noted in Puerto Rico, are *Sauvagesia erecta* in the Guánica Forest, where it was collected by Prof. J. A. Ramos, who also found it on Mona Island, and on Verbesina flowers by Mr. E. G. Smyth. It is eaten by the crested lizard.

Lace bugs collected at Isabela by Prof. J. A. Ramos has been identified by Mr. H. G. Barber as **Teleonemia prolixa** Stål.

Monanthia monotropidia Stål is a very serious pest of the younger trees of "capá prieto", as is indicated by repeated collection by Dr. Luis F. Martorell, in all parts of the Island, on *Cordia* (*Cerdana*) *alliodora*, of this very dark lace bug.

Monanthia c-nigrum Champion was collected by Dr. Stuart T. Danforth at Joyuda, and subsequent collection have been made at San Germán and Hatillo.

Phymatidae: Ambush Bugs

Phymata marginata (F.) is one of the smaller but possibly the most common of the ambush bugs in Puerto Rico. Noted by Dr. Gundlach, and also under the name *Phymata erosa* L., Dr. Wetmore found that these bugs had been eaten by the tody, a vireo and a warbler, the yellow-shouldered blackbird and by the ani. They have been collected in all parts of the Island, resting on various plants and flowers.

The ambush bugs of the genus *Macrocephalus* have a very large scutellum, covering most of the abdomen. **Macrocephalus spiculissimus,** described by Mr. H. G. Barber (1939–374), is densely covered with spicules as both adult and nymph. The spicules give it an appearance very similar to the hairyness of the twigs of *Inga vera*, one of the coffee shade trees, on which all specimens have been found: a protective resemblance that should be most useful to a predaceous insect that depends for its nourishment on other unsuspecting insects walking into its clutches.

Macrocephalus productus, also described by Mr. Barber (1939–377) has enormously produced laterally the flattened edge (connexivum) of the first two abdominal segments, and the lateral margins of the pronotum. The type was found on another coffee shade tree, *Inga laurina*, at Aibonito.

Macrocephalus crassimanus (F.) is a rather narrow, elongate species, found in xerophytic southwestern Puerto Rico as well as in the mountains, and is possibly what Dr. Wetmore found in the stomach of a tody. The living insect is light green in color, yellow on the sides, marked with brown on the prothorax and head, with reddish eyes and two red spots on the wings. This is the species which was previously incorrectly reported in "Insectae Borinquenses" (1936–160) as *M. bergrothi* Handl., on *Inga laurina* at Lares.

Macrocephalus leucographus Westwood is smaller, with the rear part of

the connexivum greatly produced laterally, almost paralleling a similar exfoliation of the pronotum. Previously reported ("Insectae Borinquenses" p. 160) as *M. granulatus* Champion, on coffee at Lares, it is also to be found along the north coast, the most recent collection being at Vega Baja, on flowers of "botoncillo" (*Borreria verticillata*), waiting for some little bee or fly to come within its grasp.

Extraneza nasuta was described by Mr. H. G. Barber (1939–380) from a single specimen intercepted by Mr. R. G. Oakley in the mountains above Yauco. It has an extraordinarily long head, longer than the pronotum.

Enicocephalidae

Mr. H. S. Barber notes a species of *Systellerodes* from Puerto Rico, and describes (1939–383) **Enicocephalus semirufus** from specimens collected at Adjuntas and Indiera. Prof. J. A. Ramos found the latter quite abundant in forest litter from the Maricao Forest.

Enicocephalus usingeri was described by Mr. Jenaro Maldonado Capriles as "A New *Enicocephalus* from Puerto Rico" (Proc. Ent. Soc. Washington, **50** (6): 159–160, fig. 3. Washington, D. C., June 1948) the types, captured in light traps at El Yunque, being characterized by having extremely large eyes.

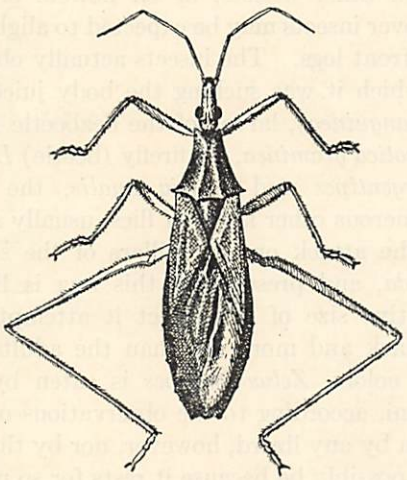
Reduviidae: Assassin Bugs

All of the Reduviid bugs are predaceous, but while some are large and conspicuous, others are small and slender. Of these comparatively minute forms, **Emesopsis nubilis** Uhler, **Empicoris rubromaculatus** (Blackburn) and **Empicoris armatus** (Champion) were collected by Dr. M. D. Leonard on Vieques Island, all of them also occurring in Puerto Rico. As a *Ploiariodes*, Messrs McAtee & Malloch (Amer. Museum Novitates No. 75, p. 7. New York, 1923) described **Empicoris barberi** from Tallaboa, Puerto Rico, and it has also been collected at Río Piedras.

Emesa affinis longipes DeGeer, as determined by Dr. Uhler, is the name given by Dr. Gundlach for his specimens of the Ploiariinae. **Ploiaria (Luteva) yunquensis,** the type from El Yunque, **Ploiaria (Luteva) maria,** the type from Ponce, others from Tortuguero Lagoon, and **Ploiaria (Luteva) poncei,** type and others from Ponce, were described as new species, differing from *P. (L.) gundlachi* (Dohrn) in the dorsolateral process on the male hypopygium, by Mr. Jenaro Maldonado Capriles (Proc. Ent. Soc. Washington, **50** (1): 18–22, pl. 1. Washington, D. C., January 1948). According to Mr. H. G. Barber's key (1939–385), the light grey Emesid spotted with black which Mr. E. G. Smyth found on thrips-infested jobo leaves is **Ploiaria gundlachi** (Dohrn), and what Smyth actually caught in the act of devouring a mosquito, resting on the walls of a room of a house

at Río Piedras, should be **Emesa tenerrima,** which Dohrn (Linn. Eng., **14:** 251. 1860) as a *Westermannia* described from Puerto Rico. As an *Emesa*, Dohrn also described (1860–266) **Ghilianella varicornis** from Puerto Rico. The very much larger **Ghilianella longula** McAtee & Malloch, 30 to 38 mm. long, has been collected at El Yunque and at Aibonito. Prof. J. A. Ramos found both the latter at Mayagüez.

The slender **Pnirontis infirma** Stål, "with ramose spines behind eye," and elbowed antennae folded up beneath a prominent beak, is sometimes attracted to lights in houses, and has been collected at Río Piedras, Isabela and Mayagüez. Mr. E. G. Smyth at Río Piedras in 1916 found them "quite common on flower heads of Amaranthus and other weeds, where they possibly capture the Capsids".



The Assassin Bug, *Stenopoda cinerea* Laporte, twice natural size. (Drawn by Fritz Maximilien.)

Much larger and broader and darker, the wings marked with dark brown, is **Stenopoda cinerea** Laporte, listed by Dr. Stahl, which Dr. Gundlach reported under Fabricius' preoccupied name of *culiciformis*. It also is attracted to lights. Another darker species, with shorter wings marked with two rounded dark brown spots, has been collected at light at Río Piedras.

Rasahus biguttatus (Say) (= *R. hamatus* (F.)) has been collected at Yabucoa and in a grapefruit grove near Río Piedras.

Heza pulchripes, described by Stål from Puerto Rico (Oefv. Vet.—Akad. Forh., 199. 1859), apparently occurs only here, as does **Heza angulifer,** described by Mr. H. G. Barber (1939–389) from Puerto Rico, with

collections made in all parts of the Island. The posterior lobe of the pronotum of both species has four distinct spines.

That of **Zelus subimpressus** Stål, a slender greenish-brown species, has but two small spines. Dr. Richard T. Cotton found egg-clusters, nymphs and adults quite abundant in a grapefruit grove at Vega Alta. The eggs are arranged in a hexagonal mass in regular, alternating rows of four or five on each edge of a hexagon, totaling 52, standing erect surrounded by a reddish-brown adhesive. This Reduviid was listed by Dr. Gundlach as a *Diplodus*.

Zelus longipes (L.) (= *Zelus rubidus* L. & S.), a large black and red species, is by far the most obvious and one of the most common of the assassin bugs in Puerto Rico. It is to be found on knee-to waist-high corn swarming with other insects, or on flowers of botoncillo or wild heliotrope, or wherever insects may be expected to alight within reach of its long, black, sticky front legs. The insects actually observed which it had caught and from which it was sucking the body juices include the lady-beetle (*Cycloneda sanguinea*), larvae of the fleabeetle *Haltica jamaicensis*, the fleabeetle *Diabrotica graminea*, the firefly (beetle) *Lucidiota decorus*, the wasps *Tachytes argentipes* and *Alysia analis*, the house fly (*Musca domestica*), and numerous other kinds of flies, usually smaller. Mr. Thos. H. Jones records the attack on caterpillars of the southern grassworm, *Laphygma frugiperda*, and presumably this bug is limited only by the quickness and relative size of the insect it attempts to capture. The nymphs are less black and more red than the adults, yet despite these reputedly warning colors, *Zelus longipes* is eaten by the kingbird, the petchary and the ani, according to the observations of Dr. Wetmore. It was not found eaten by any lizard, however, nor by the imported Surinam toad, but this may possibly be because it rests for so much on the time on the very tips of vegetation where it would not be readily caught by terrestrial animals. It is especially partial to the fruiting stalks of "rabo de gato" (*Achyranthes indica*). It occurs in all parts of Puerto Rico, and on Mona and Vieques Islands, and was listed by Dr. Gundlach. Under the name *Evagoras tricolor* L. & S., Dr. Stahl records its early presence here.

Mr. H. K. Plank discovered the nymphs of "**Peregrinator biannulipes** (Montr.) a Predator on the Bamboo Powder-Post Beetle in Puerto Rico" (Jour. Ec. Ent., **32** (1): 151. Menasha, February 1939) to be quite abundant at Mayagüez, attacking the adult beetles as they emerged from their galleries in the bamboo, but despite their abundance in the autumn and winter, of little importance in the economic control of the pest. Prof. J. A. Ramos found both nymphs and adults on the walls of a room where cattle feed is stored by the College of Agriculture.

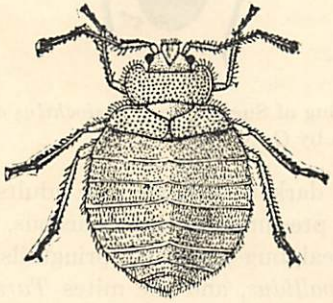
Narvesus caroliniensis Stål, as determined by Mr. H. G. Barber, has been collected in the Luquillo Mountains, and at light at Gurabo.

Nabidae: Damsel Bugs

In "A Monographic Study of the Hemipterous Family Nabidae as it occurs in North America" (Entomologica Americana, 9 (1 & 2): 1–90. Scarsdale, N. Y., 1928) Dr. Halbert M. Harris describes (p. 78, pl. 4) **Metatropiphorus drakei** from Utuado, and notes the occurrence of his **Carthasis gracilis** in Puerto Rico. Dr. Richard T. Cotton collected a single specimen of the latter on grapefruit foliage at Vega Alta in 1917, identifying it as *Carthasis rufonotatus* Champion, of which another synonym is *C. minor* Reuter.

Neogorpis neotropicalis was described by Mr. H. G. Barber (1923–78) from Aibonito and Adjuntas, a slender "sordid-yellow white" bug marked with dilute red, illustrated (1939–397) without additional records.

Only single specimens of **Pagasa fusca** (Stein), **Nabis spinicrus** Reuter and three of **Nabis sordidus** Reuter have been collected in Puerto Rico. Prof. J. A. Ramos found **Nabis capsiformis** Germar on Mona Island, previously known in Puerto Rico only from a collection on string beans at Loíza.



The Bed Bug, *Cimex hemipterus* L. Greatly enlarged. (After Marlatt.)

Cimicidae: Bed Bugs

The tropicosmopolitan bed bug, **Cimex hemipterus** (F.), occurs in Puerto Rico, and on Mona and Vieques Islands, but not, according to Mr. H. G. Barber (1939–398), the temperate zone species, *Cimex lectularius* L. The control of bed bugs is much simpler since the popularization of DDT has made readily available a really effective insecticide against this pest. To be sure, heavy concentrations must be used for prompt effectiveness,

but 10 per cent DDT in kerosene or benzol will give satisfactory results which even the most thoro applications of kerosene alone or boiling water were not able to obtain previously.

Polyctenidae

While on Vieques Island in 1899, Mr. August Busck collected on a bat specimens of an ectoparasitic bug, **Hesperoctenes fumarius** (Westwood), not since found there or in Puerto Rico.

Anthocoridae: Minute Pirate Bugs

All stages of the pink leaf-sheath bug of sugar-cane, **Lasiochilus divisus** Champion, are found under the older leaf-sheaths of high cane in all parts of the Island, and on Vieques. The smallest nymphs are light pink in

The pink Leaf-Sheath Bug of Sugar-Cane, *Lasiochilus divisus* Champion, twelve times natural size. (Drawn by G. N. Wolcott.)

color, the larger ones a darker pink, and the adults light brown in color. All the Anthocorids are presumed to be predaceous, and many other small insects, such as small mealybugs, psocids, springtails, earwigs, the larvae of the beetle *Telephanus pallidus*, and the mites *Tarsonemus bancrofti*, live under cane leaf-sheaths and might fall prey to these bugs.

Lasiochilus pallidulus Reuter was collected on Vieques Island by Dr. M. D. Leonard, and has also been found, as was **Lasiochilus microps** Champion, at various points in Puerto Rico.

Xylocoris sordidus (Reuter) was found by Dr. Frank E. Lutz on Mona Island, and it also occurs in Puerto Rico.

Adults or nymphs of the little dark brown **Asthenidea picta** (Uhler) were found in abundance in the buds of "majagua" (*Pariti tiliaceum*) at Arecibo in the midsummer of 1922, but with no obvious reason for their being there at all, and certainly not in such numbers. Dr. M. R. Smith (1942–26) notes that "no ants were seen pursuing, attacking or killing these

insects" on scale-infested coffee plants in the mountains back of Mayagüez, which he presumes to be predators on the hemispherical and green scale insects. Prof. J. A. Ramos swept these little bugs from herbage on Mona Island.

Dr. H. L. Dozier (1927–280) first noted that heavy infestations of the thrips on "laurel de la India" (*Ficus nitida*) foliage were to some extent reduced by the attack of the finely pilose **Cardiastethus rugicollis** Champion, which he did not identify as to species, and the black and very shiny **Macrotracheliella laevis** Champion, which had been identified by Dr. C. J. Drake for him as *M. nigra* Parshley. Both have since been found thus associated with thrips on this host, and the former was swept from herbage by Prof. J. A. Ramos on Mona Island.

Mr. H. G. Barber collected **Paratriphleps pallidus** (Reuter) at San Juan, as well as in the Virgin Islands.

Because it was first observed feeding on the contents of the eggs of the corn earworm in the States, what was at that time called *Triphleps*, and is now known as **Orius insidiosus** (Say), is historically the most important of these little black Anthocorid bugs. The first record for Puerto Rico is by Mr. Thos. H. Jones, who observed it on corn, but thought that the aphids (*Aphis maidis* Fitch) and fulgorid nymphs (*Peregrinus maidis* Ashmead), present in abundance, were the insects attacked. Red spiders, on bean foliage, and on cotton leaves at Isabela, have been noted sucked dry. The bugs have also been intercepted on the flowers of "margarita" (*Bidens pilosa*) at Guayama, on *Pluchea purpurascens* at Pt. Cangrejos, on squash leaves and under the leaf-sheaths of sugar-cane, in all of which habitats they should find an abundance of small insects on which to feed, so many indeed that it is difficult to be specific as to those actually eaten.

Miridae: Plant Bugs

One of the largest of the plant bugs (Miridae or Capsidae), easily recognized by the prominent dark spots near the humeral angles of the pronotum, is **Collaria oleosa** (Distant), first recorded from Puerto Rico as a *Nabidea*, present in large numbers on Pat McLain's ill-fated low-land rice plantation at Canóvanas. It has also been noted on malojillo, and on Solanaceous plants and others in the more humid parts of the Island.

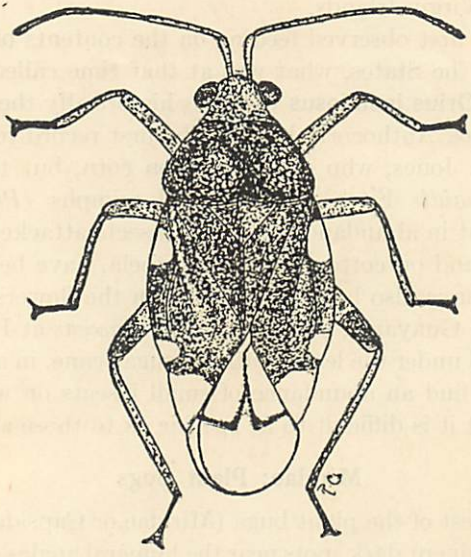
Creontiades rubrinervis (Stål) inhabits the same type of swampy malojillo meadow environment, but Prof. J. A. Ramos swept it from grass on Mona Island, a much dryer region than any from which it is recorded in Puerto Rico.

What Dr. Reece I. Sailer thinks must be "without any question" **Trigonotylus brevipes** Jakovlev occurs in great abundance on Bermuda grass.

Polymerus cuneatus (Distant,) identified by Mr. W. L. McAtee as a

Poecilocytus and thus reported in "Insectae Portoricensis" (1923–245), may at times be very abundant on the foliage of beans, and less so on the leaves of tomato, tobacco, carrots, dahlia, cotton, "blero" (*Amaranthus* spp.), the wild "margarita" (*Bidens pilosa*) and even on the leaves of sugar-cane. Mostly black or very dark brown in color, it has a prominent yellow spot on the scutellum, and is comparatively short and plump. It occurs in all parts of the Island and Prof. J. A. Ramos has swept it from weeds on Mona Island.

A much smaller little black bug with narrowly banded transparent wings, found on weeds in a cane field, in malojillo meadows and on cohítre grass in the mountains, early identified by Mr. E. H. Gibson as *Bolbosia deflexa* Uhler MS, Dr. R. I. Sailer states is **Pycnoderes heidemanni** Reuter.



The black Squash Mirid, *Pycnoderes quadrimaculatus* Guérin-Méneville, ten times natural size. (Drawn by R. T. Cotton.)

The small black squash bug, as Dr. Richard T. Cotton (1918–306) called **Pycnoderes quadrimaculatus** Guérin-Méneville (= *P. incurvus* Distant), tends to become a serious pest on that vegetable. It also may occur on cucumber, pumpkin and on "blero" and generally on weeds in gardens. Indeed, it is so common at times as to form an item in the food of the crested lizard. Most recently, Dr. Luis F. Martorell found it on beans on Mona Island.

Dr. Gundlach gives the name *Lygus sallei* Stål for what has more recently

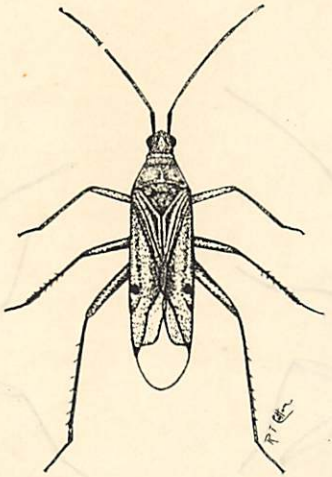
been identified as **Lygus apicalis** Fieber, a common little, light green bug found on weeds, specifically on *Pluchea purpurascens* at Pt. Cangrejos, on carrots, and on tender growth of *Inga laurina* at Lares. More recently it has been collected at light on Mona Island.

Lygus fasciatus Reuter on wild daisy or "margarita" (*Bidens pilosa*), and **Lygus olivaceous** Reuter on pomarrosa flowers (*Eugenia jambos*) have been collected once.

Cyrtocapsus caligneus Stål has been found on squash and sweet potato leaves.

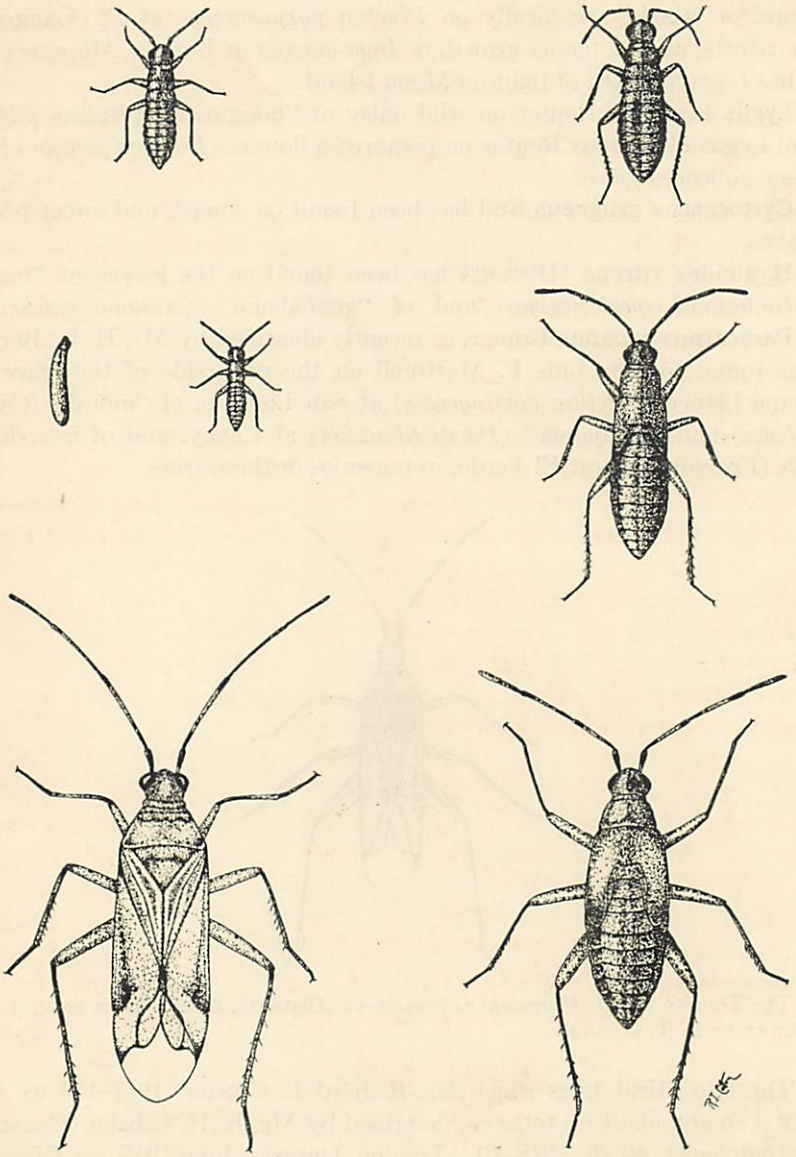
Hyaloides vitreus (Distant) has been found on the leaves of "maga" (*Montezuma speciosissima*) and of "guanábana" (*Annona muricata*).

Paracarnus cubanus Bruner, as recently identified by Mr. H. G. Barber, was found by Dr. Luis F. Martorell on the underside of the leaves of "capá blanco" (*Petitia domingensis*) at San Lorenzo, of "moral" (*Cordia sulcata*) and "emajagua" (*Pariti tiliaceum*) at Cayey, and of introduced ash (*Fraxinus* sp.) at El Verde, in nurseries of these trees.



The Tomato Mirid, *Macrolophus praeclarus* (Distant), fifteen times natural size. (Drawn by R. T. Cotton.)

The two Mirid bugs which Dr. Richard T. Cotton (1917–113 to 119) found so abundant on tobacco, described by Mr. E. H. Gibson (Canadian Entomologist, **49** (6): 218–19. London, Ontario, June 1917) as *Dicyphus prasinus* and *Dicyphus luridus*, have since been re-identified and are known as **Macrolophus praeclarus** (Distant) and **Cyrtopeltis varians** (Distant). The former, slighter and more slender, has "a large irregular fuscuous spot near the costal margin of each wing-cover and midway between base and



The large Tobacco Suck-Fly, *Cyrtopeltis varians* (Distant): all stages, egg to adult. About fifteen times natural size. (Drawn by R. T. Cotton.)

apex", and is not so abundant on tobacco as on tomato. The latter, of which Dr. Cotton made a drawing of all stages and named the "Large Tobacco Suck-Fly", is at times so abundant on the few tobacco plants left in the field for seed as to seriously affect the amount of seed produced and the germination of what does mature. Adults have also been found on *Adenoropium gossypifolium* and *Amaranthus spinosus*, and in a grapefruit grove at Añasco.

Macrolophus separatus Uhler, as determined by Mr. H. G. Barber, has been collected on tobacco at Juana Díaz, and **Cyrtopeltis tenuis** Reuter on tomato at Bayamón.

Mr. H. G. Barber has identified individual collections intercepted by the Federal Plant Quarantine Inspectors as follows:

Halticus nigricornis? Reuter, on tomatoes at Jayuya,
Hemisphaerodella mirabilis Reuter, on pineapple at Lajas,
Reuteroscopus uvidus Distant, on alfalfa at Arecibo, and
Psallus politus Uhler, on grass.

On the foliage of orange or grapefruit have been plant bugs identified as *Neofurius* sp. ?, apparently a new species of *Fucus* Distant, and *Chlamydatus* sp., near *suavis* Reuter.

To these records, Prof. J. A. Ramos adds:
Phytocoris sp., from Vieques Island,
Eustictus sp., at Ponce and Mayagüez,
Sixenotus sp., on cohítre at Consumo, and
Halticus sp., on sweet potato at Mayagüez.

Cryptostemmatidae

The pale, chocolate-brown, somewhat shining **Ceratocombus vagans** McAtee & Malloch has been found on dead leaves at Río Piedras and Jayuya.

Hydrometridae: Marsh-Treaders

Hydrometra consimilis, described by Mr. H. G. Barber (1923–9) from Coamo Springs, has since been collected at Añasco, Lajas and Hormigueros.

Gerridae: Water Striders

The relatively short and broad **Rheumatobates imitator** Uhler has been found on the surface of the Guayabal reservoir.

Metrobates laudatus Drake & Harris was described (Revista Entomología, 7 (4): 357. Rio de Janeiro, October 1937) from apterous male water striders collected at Juana Díaz and Río Piedras. It has entirely black antennae.

The more elongate, glistening dark brown or black **Limnogonus franciscanus** (Stål) its pronotum margined with yellow, is the common water strider to be found in bodies of water everywhere in Puerto Rico and on Mona, Culebra and Vieques Islands. Dr. Stahl's name of *Gerris marginatus* Guérin, Dr. Gundlach's of *Limnotrechus*, and that in Mr. Barber's preliminary list of *Tenagogonus guerini* L. & S., as well as that given to Van Zwaluwenburg by Mr. O. Heidemann of *T.* (*Limnometra*) *quadrilineatus* Champion, all refer to the same common insect. Dr. Wetmore found that, of aquatic birds, only the green heron had eaten it.

The dull, dark **Gerris remigis** Say has been collected at Quebradillas and at Ponce, and **Gerris cariniventris** Champion in the mountains.

Veliidae

The pools or "charcas" of the Isabela region are an especially favored habitat for the little black Veliid bugs, of which Dr. Wetmore found that both the killdeer and the spotted sandpiper had eaten. **Microvelia capitata** Guérin-Méneville, **Microvelia paludicola** (Champion), **Microvelia pulchella** Westwood and **Microvelia robusta** Uhler are the species found at the margins of streams and pools in all parts of the Island, the latter occurring also on Mona. Dr. Gundlach listed *Microvelia pulchella*, but many of the more recent collections have been made by Dr. W. A. Hoffman.

Rhagovelia plumbea Uhler occurs in xerophytic Puerto Rico, having been found at Boquerón and at Ponce Playa; the common species is **Rhagovelia collaris** (Burmeister) found also on the south coast, but more often in the mountains: at Maricao and on El Yunque.

Saldidae: Shore Bugs

Pentacora sphacelata (Uhler) has been collected near the shore of Puerto Rico.

Pentacora signoreti (Guérin-Méneville) has been found around the margins of salt-water pools on the beaches near Arecibo, Mayagüez, Boquerón and Maunabo, and is very abundant in the specialized environment in which it only occurs.

Saldula pallipes (F.) has been collected at Ensenada, and **Saldula interstitialis** (Say) was found abundant at Guánica Lagoon by Prof. J. A. Ramos.

Micracanthia sulcata, described by Mr. H. G. Barber (1939–415), the type from Coamo, others on weeds at Ciales, has been found in abundance by Prof. J. A. Ramos at Cartagena Lagoon. A single small specimen, identified by Mr. Barber as doubtfully *Micracanthia humilis* (Say), is from San Juan.

Pleidae

Dr. Wetmore found that the water thrush, the sandpiper, the gallinule and the black swift had eaten some of the little thick-bodied bugs (Pleidae) described by Mr. H. G. Barber (1923–10 to 11) as **Plea puella** and **Plea punctifer**, of which he later published (1939–418 and 419) illustrations. Dr. Stuart T. Danforth found that they had been eaten by the little blue heron and that they were especially abundant on the shores of Cartagena Lagoon, where he conducted his first extensive ornithological observations.

Notonectidae: Back Swimmers

Dr. Wetmore found fragments of back swimmers in the stomachs of sandpipers and of the ani, and Dr. Danforth, of the green heron and the yellow-shouldered blackbird. **Notonecta indica,** the original name given by Linnaeus in 1771, is still correct for the species found in all parts of Puerto Rico, from El Yunque to Cartagena Lagoon. It has an extensive distribution, found also in St. Thomas and St. Croix, but not recorded from Vieques, Culebra or Mona.

Buenoa macropthalma (Fieber) lives in mountainous streams in Puerto Rico. It "occurs in two forms with both sexes represented in each, one for the most part black, the other entirely pale, the latter in all of the specimens seen having the hind wings abbreviated".

Buenoa femoralis (Fieber), "pale cinereous, hyaline" 8.0 – 8.5 mm. long, was described from Puerto Rico (Rhynchota, 59, 1851) and is also found on Mona Island.

Buenoa pallipes (F.), smaller and lighter-colored, occurs thruout Mexico and the West Indies, with records of collection in both Mona and Culebra Islands. A fourth undescribed species occurs in Puerto Rico, close to *B. albida* Champion.

Naucoridae: Water Creepers

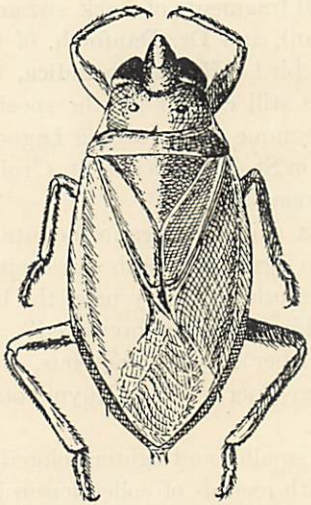
Pelocoris femorata (Palisot de Beauvois) is the only species of Naucoridae found in Puerto Rico, all records of collection being from the lagoons in the southwestern corner of the Island. In observing the "Birds of the Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1926), Dr. Stuart R. Danforth notes that the nymphs, locally known as "cucarachas de agua", inflict a painful sting on man. He found that 94% of the stomach contents of a gull-billed tern which he examined consisted of this insect, and that nymphs or adults formed a large fraction of the food of the grebe, the snowy egret, both herons, the pectoral sandpiper, the ani and the yellow-shouldered blackbird.

Nepidae: Water Scorpions

Ranatra insulata was described by Mr. H. G. Barber (1939–423) from specimens collected by Dr. Danforth at Las Marías. Prof. J. A. Ramos has found it at Mayagüez and at Faro de Cabo Rojo. It is extremely slender and elongate, the body alone being 35.0 mm. long.

Belostomatidae: Electric Light Bugs

The smaller and more common of the electric light bugs is **Belostoma boscii** (Lepeletier & Serville) (= *Zaitha anura* H. S.), averaging about an



Belostoma fuscigera Stål, an Hispaniolan Electric Light Bug, not known to occur in Puerto Rico, twice natural size. (Drawn by Fritz Maximilien.)

inch in length. Dr. Gundlach reports it "en las lagunas", before the day of electric lights, but most of the collections made since have been at light. Dr. Danforth found that it had been eaten by the blue heron, and Mrs. Raquel Dexter by the introduced toad, *Bufo marinus*. Indeed, during the years when the toad was most abundant, no collection of this bug was made by entomologists.

The common large electric light bug, **Lethocerus annulipes** (Herrich-Schaeffer), was reported by Drs. Gundlach and Stahl under the name *Belostoma medium* Guérin. It averages considerably more than two inches in length, too large, it would seem to us, to be easily swallowed whole by the introduced toad. It seems no more abundant now, since the introduction of *Bufo marinus* furnished an abundance of pollywog food for its

nymphs and adults, than before this addition to the Island's fauna. Birds have less difficulty in eating it, and Dr. Danforth found it in the stomach contents of both herons, the greater yellow-legs, lesser scaup and Allen's and ruddy ducks. On August 18, 1948, Mr. Mario E. Pérez found one adult in the alimentary tract of the common bullfrog, as reported in his paper on "The Food of *Rana catesbiana* Shaw in Puerto Rico" (Jour. Ec. Ent., *in press*), introduced here in 1935 and now audibly abundant generally along the coast. That the adult electric light bug is eaten by the frog is no more than just retribution for all the pollywogs eaten by its aquatic larvae.

A single specimen of **Belostoma minor** Duf. has been found in Guánica Lagoon.

Lethocerus del-pontei De Carlo is reported from Puerto Rico by Mr., Carl Cummings ("The Giant Water Bugs, Belostomidae—Hemiptera", Sci. Bul. Univ. Kansas, **21** (2): 197–219, pl. 2. Lawrence, March 1933), but is presumably rare, and difficult to distinguish from *Lethocerus annulipes*.

Corixidae: Water Boatmen

Trichocorixa reticulata (Guérin-Méneville), reported by Dr. Gundlach as a *Corixa*, is an important item in the food of many shore and aquatic birds in Puerto Rico, Dr. Wetmore finding that it constituted 57.5% of the stomach contents of the lesser yellow-legs collected at Cabo Rojo, and over 50% of the black-necked stilt. He also found that it had been eaten by the lesser scaup duck, the killdeer, sandpipers, Wilson's snipe, and ani, woodpecker and grasshopper sparrow, and Dr. Danforth by the gull-billed tern, snowy egret, white-rumped sandpiper and the ani. Most of the collections of the insect by entomologists have been made in the south-western corner of the Island, but it has been found in a jasmin flower at Bayamón, and Dr. W. A. Hoffman in the swimming pool at El Semil, near Villalba.

On Mona Island, Prof. J. A. Ramos (1947–23) found **Trichocorixa verticalis** (Fieber), as identified by Dr. Reece I. Sailer, "abundantly in several small pools of stagnant water along Sardinera Beach, April 16 and August 11–31, 1944. This is a North American species which has not yet been found in Puerto Rico itself. It can be easily distinguished from other species by its robust form and the large frontal depression of the males."

Prof. J. A. Ramos also has numerous specimens collected at light at Mayagüez, Barranquitas and Juana Díaz identified by Mr. H. G. Barber as a species of **Arctocorixa**.

Dr. H. B. Hungerford identifies specimens from Mayagüez as **Centrocorisa kollari** Fieber.

Condensed Index of Insex*

By C. R. Hartzell

All bugs
Have mugs
Like Thugs!

At every chance
Ants
Get in pants!

Moths
Love cloths!

Lice
Aren't nice!

Termites
Work nights!

Fleas?
Jeez!

Comejens
Have no fren's!

Never tease
Bees!

Always mistreat a
Mosqueata
And always bang a
Changa!

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THE INSECTS OF PUERTO RICO

By *George N. Wolcott*

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[1] As of date of issue—August, 1950
[2] Leave to pursue studies
[3] Other leaves

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THE INSECTS OF PUERTO RICO

COLEOPTERA

By GEORGE N. WOLCOTT

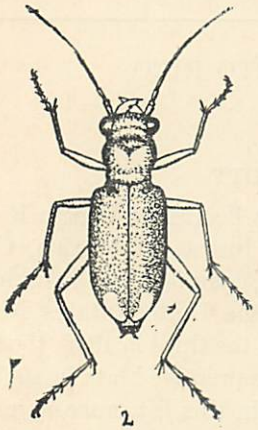
The very latest authoritative names for the beetles of Puerto Rico are included in the "Checklist of Coleopterous Insects of Mexico, Central America, the West Indies and South America", compiled by Dr. Richard E. Blackwelder. This is Bulletin No. 185 of the United States National Museum, of which two parts appeared in 1944, the third in 1945, the fourth in 1946, while the fifth and concluding part was received late in 1947. As indications of generic transfers are not given in this list, none is included in the following pages. His changes in the gender of specific names are followed in the first citation even of economic insects, but often not subsequently.

Cicindelidae: Tiger Beetles

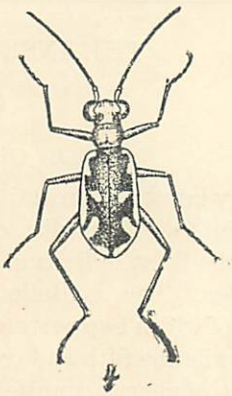
The "Descriptive Catalog of the West Indian Cicindelinae" (Bulletin Amer. Mus. Nat. Hist., **35** (36): 681–699, pl. 1, fig. 5. New York, October 17, 1916) by Dr. C. W. Leng and Mr. A. J. Mutchler, gives illustrations of the four species found in Puerto Rico, and of the alkali flat at Guánica where some of them were collected by the writers.

Megacephala sobrina Dejean, var. **infuscata** Mannerheim, called by Drs. Stahl and Gundlach *Tetracha infuscata* Chaudoir, is mostly an iridescent purplish green beetle, the apex of its elytra a semi-transparent yellowish brown. Its prominent mouth-parts, slender antennae and legs are opaque yellowish-brown. Mr. W. V. Tower (First Rpt. Bd. Comm. Agr. P. R., p. 20. San Juan, Jan. 1, 1912) states that it is predaceous on the changa, but we really know very little about what insects it normally feeds upon, as it is not often seen, and relatively few collections of it have been made. It is active only at night, but is neither attracted nor repelled by light. According to Leng & Mutchler it hides during the daytime under dung and debris around the higher part of the alkali flat at Guánica. It is not confined to such an environment, however, for it has been collected in all parts of the Island, in the mountains and along the coast, and in cultivated fields. Despite the speed with which this beetle runs, it is caught and eaten by the introduced toad, *Bufo marinus* (L.), as was first reported by Mrs. Raquel Dexter (1932–5), and its remains have since been found in toad excrement, the elytra being unmistakable. It is possibly for this reason that the beetle has been no more abundant in recent years.

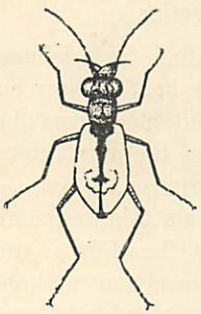
Cicindela boops Dejean has iridescent dark green legs, but is mostly lighter green, coppery, the lateral margins of the elytra whitish. In Puerto Rico it occurs only around alkali flats and near the salt ponds of the south-



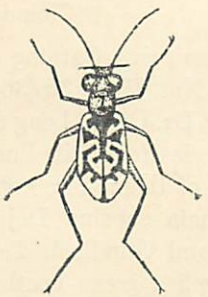
Megacephala sobrina Dejean var. *infuscata* Mannerheim. (After Leng & Mutchler.)



Cicindela boops Dejean. (After Leng & Mutchler.)



Cicindela suturalis F. (After Leng & Mutchler.)



Cicindela suturalis var. *hebraea* Klug. (After Leng & Mutchler.)

western corner of the Island: at Faro de Cabo Rojo, Parguera, Guánica and Ensenada.

Cicindela suturalis F., with elytra mostly whitish, is reported from Puerto Rico by Leng & Mutchler, but all collections at definite localities are of the variety **hebraea** Klug, which has more of the elytra green. Drs. Stahl and Gundlach noted the latter, and recent collections have been made at Añasco, Aguadilla and Camuy.

The elytra of **Cicindela trifasciata** F. are mostly dull, dark green, with a narrow pattern in white. This is the common species, reported by Drs. Gundlach and Stahl under the name *C. tortuosa* Dejean, often found in great abundance on the beaches all around the Island, but especially on the north coast, as at the ferry landing at Loíza Aldea and on Pt. Picua, Mameyes. It also occurs on the sandy banks of fresh water streams, and even in sandy cane fields, as well as on the margins of the salt lagoons of the south coast. One can but wonder what all these beetles and their larvae find to feed upon, for at times they are so much more numerous than any other insect or other small animal present on these sandy beaches. The larvae, like the adults, are entirely predaceous, and depend for their food on whatever happens to fall into their open burrows in the soil.

Carbidae: Ground Beetles

Calosoma alternans F. is the only large predaceous ground beetle that occurs in Puerto Rico. It averages an inch in total length, and in color is a dark greenish bronze, with three rows of iridescent pinkish punctures on each deeply striate elytron. Noted by the earlier entomologists under the name given by Fabricius that has persisted unchanged since 1791, it was later recorded by Mr. R. H. Van Zwaluwenburg as attacking the caterpillars of the cane looper (*Mocis repanda*) and white grubs, while Mr. Thos. H. Jones thought it probably predaceous on the southern grassworm (*Laphygma frugiperda*). The adults, being nocturnal in habits, seem not very common, but Dr. Wetmore found that they had been eaten by the ani, and Mrs. Dexter by the introduced toad. Collections have been made in all parts of the Island, usually on pavements in towns, feeding on the insects attracted to lights, but sometimes the beetle is disturbed when a field is being plowed, and runs distractedly about in search of shelter.

Scarites montana (= *S. mutchleri* Bänninger), described by Mr. A. J. Mutchler (Amer. Mus. Novitates No. 686, pp. 5. New York, January 6, 1934), the type from El Yunque, is a comparatively large (17.0 mm. long), black, elongate beetle which he thought might be the "*Scarites subterraneus* Fabricius recorded by Stahl".

At an elevation of 3,000 feet in the Maricao Forest was collected the type of **Scarites danforthi**, one of the many new species of Carabid beetles which Dr. P. J. Darlington, Jr. found in Puerto Rico, of which descriptions were published in a series of articles beginning in 1934–5 in "Psyche" and concluded in the April 1939 number of Mem. Soc. Cubana de Historia Natural. Most of the recent collections of Carabids in Puerto Rico were made or inspired by Dr. Darlington, who was always ready to identify or describe the new species collected by others.

As **Oxydrepanus coamensis**, Dr. Darlington notes the collection on El

Yunque of what Mr. Mutchler (1934–2) described as a *Dyschirius*, "length 2.0 mm., shining, reddish, prothorax globose".

The elongate, yellowish-brown **Clivina limbipennis** DuVal has been collected at Mayagüez and Cabo Rojo, and the black **Clivina addita** Darlington at Mayagüez. The small reddish-brown **Clivina insularis** DuVal has been found at many localities, at Tortuguero, Cartagena and Guánica Lagoons, and Mr. E. G. Smyth, making collections under cow dung at Guánica, thought it might be predaceous on horn-fly eggs and larvae.

The minute coppery iridescent **Ardistomus mannerheimi** Putzeys and the black **Aspidoglossa aerata** Putzeys have been collected only at Mayagüez, but the larger, shining black and reddish-brown **Aspidoglossa vulnerata** Putzeys, reported by Drs. Stahl and Gundlach under the name *A. bipustulata* F., is presumably more common, and has been collected elsewhere on the Island.

The type of the "slightly convex, piceous, shining, length 3.5 mm." **Bembidion darlingtoni** Mutchler (1934–3) was from Ensenada, and Dr. Danforth collected many specimens at the Cartagena Lagoon, but it has also been found at Ponce, Coamo and Caguas. The type of the shining **Bembidion portoricense** Darlington is from El Yunque. **Bembidion fastidiosum** LaFerte and the dull black **Bembidion sparsum** Bates are apparently mountainous species, but **Bembidion viridicole** LaFerte (= *B. chevrolati* C. & H.) was collected at Ensenada by Prof. J. A. Ramos. Dr. Wetmore found that the semipalmated sandpiper had eaten some one of these species of *Bembidion*. The "oblong, parallel, testaceous, in great part dark brown, length 2.25 mm." **Tachys ensenadae** described by Mr. A. J. Mutchler (1934–3) from a type at Ensenada and others at Arecibo, was found in abundance by Dr. M. D. Leonard on Vieques Island, and Prof. J. A. Ramos has specimens from Mona Island. Dr. Gundlach reports **Tachys macrodentra** Chevrolat and **Tachys vittiger** LeConte, and more recent collections have been made of **Tachys blandula** Schaum, **Tachys corrusca** LeConte, **Tachys carib** Darlington, **Tachys piceola** LaFerte and the light-colored **Tachys vorax** LeConte.

The holotype of **Micratopus insularis** Darlington (1934–86) is from San Juan, but it has since been taken at Humacao. It has a very small head and is less than 2.0 mm. in total length.

The little, light yellow **Perileptus dentifer** Darlington (1935–177) lives in the gravel of the river at Mayagüez, and Mr. R. G. Oakley intercepted it at Ponce.

Panagaeus quadrisignatus Chevrolat is the presently accepted name for what was recorded by Dr. Gundlach as *Panagaeus fasciatus* Say, a rather common and certainly a very distinctive black beetle with two irregular

chestnut spots on each deeply furrowed elytron, found in all parts of the Island. It is three-eights of an inch long and almost half as broad.

Morion georgiae Palisot de Beauvois, listed by Drs. Stahl and Gundlach as *Morio monilicornis* Latreille, was reported from Vieques Island by Leng & Mutchler.

Loxandrus celeris Dejean was collected at Guánica Lagoon by Prof. J. A. Ramos.

On Mona Island, Prof. J. A. Ramos found numerous specimens, identified as a species of **Tetragonoderus** by Mr. J. M. Valentine, none of this genus being known from Puerto Rico.

Colpodes estriata was described by Dr. P. J. Darlington (1939–96) from specimens taken on El Yunque.

Lachnophorus leucopterus Chevrolat, with small head and thorax, grey elytra with three deep punctures on each, has been collected at Mayagüez, and in river gravel at Maricao.

In 1899 at Bayamón, Mr. August Busck collected the type, and another at Fajardo, from which Dr. P. J. Darlington (1934–99) described **Perigona microps,** since found also on dead wood at Villalba.

Chlaenius perplexus Dejean, a large dull brown beetle, has been collected at Mayagüez, Arecibo and Luquillo.

(Dr. Stahl lists *Oodes femoralis* Chaudoir.)

Stenocrepis metallica Dejean has been collected at the Cartagena Lagoon and at Ponce. The much more common **Stenocrepis tibialis** Chevrolat, listed by Drs. Stahl and Gundlach as a *Stenous*, dark green and bronze in color, is also from the southwestern corner of the Island. Dr. Stuart T. Danforth, in his study of the food habits of the birds of Cartagena Lagoon, found that this beetle was eaten by three kinds of sandpipers, the killdeer, the lesser yellow-legs and the northern water thrush.

Gynandropus guadeloupensis Fletiaux & Sallé, a dark iridescent greenish-black Carabid, has been collected at Humacao and Mayagüez.

Twelve species of *Selenophorus* are known to occur in Puerto Rico, of which the types or paratypes of four were collected on the Island. **Selenophorus alternans** Dejean, with the elytra deeply punctate and only faintly striate, is a very common species, noted by Dr. Gundlach, and since collected in all parts of the Island, usually at light. It has also been found on Mona Island by Prof. J. A. Ramos, "under stones near the cliff" and under dead leaves. **Selenophorus beauvoisi** Dejean has been collected at Ensenada. **Selenophorus chalybaeus** Dejean, a large black species with deeply striate elytra, the largest of the genus in Puerto Rico, has been taken at Guánica and at Coamo. Dr. Gundlach collected **Selenophorus discopunctatus** Dejean, and it has since been found under lights

on Vieques Island and at Aibonito and at Bayamón. Concerning **Selenophorus flavilabris** Dejean, nothing more definite than Puerto Rico is known as to place of collection. Dr. P. J. Darlington described **Selenophorus latior** (1934–109) from the type collected (GNW) at Haina, Dominican Republic, with paratype collected (GNW) from one square foot of pasture at Pt. Cangrejos, Puerto Rico. It occurs in dead seaweed on the beach there, and has subsequently been found on the ground at Jayuya. **Selenophorus puertoricensis** was described by Mr. A. J. Mutchler (1934–5) as "aeneous, greenish to coppery on pronotum, coppery on the elytra, length 10.0 mm." from Desengaño, others from Mt. Mandios. Drs. Stahl and Gundlach list **Selenophorus pyritosus** Dejean. The little shining black **Selenophorus sinuatus** Gyllenhal has been found at Jayuya, Caguas and Cayey, the peons calling it "cucaracha" and claiming that it attacks tobacco leaves. Prof. J. A. Ramos found it at Cartagena Lagoon, and "under stones near the cliff at Sardinera Beach" on Mona Island. The holotype of **Selenophorus parvus** Darlington (1934–105) is from Coamo Springs, and "resembles a small *S. sinuatus*". The type of **Selenophorus ramosi** Darlington (1939–97) was from Guánica Lagoon, and it has also been collected at light in the Guánica region. **Selenophorus striatopunctatus** Putzeys has been found in the mountains and along the coast of western Puerto Rico.

The paratypes of **Bradycellus (Stenocellus) velatus** Darlington (1934–111) were collected at Río Piedras.

Acupalpus ochropezus Say, also listed as a *Stenolophus*, has been collected in all parts of the Island.

The type of **Masoreus (Aephnidius) ciliatus** Mutchler (*in* Darlington 1934–130) was collected on a cactus-covered hill at Ensenada.

The bright iridescent blue-green of **Lebia viridis** Say (which Dr. Darlington re-identifies as *Lebia marginicollis* Dejean) is very conspicuous among the dark or dull-colored Carabids. The duller **Lebia bitaeniata** Chevrolat has two yellow bands across dull blue elytra. Both species have been collected mostly at Río Piedras, Dr. R. T. Cotton noting of the former, found on cucumber vines, that "it was probably feeding on aphids".

The type of **Phloeoxema portoricensis** Darlington (1939–99) is from El Yunque, and others have been collected in the Maricao Forest. It has striate, dull blue-black elytra, and is mostly yellowish elsewhere.

The margins of the elytra of the dull brown **Apenes marginalis** Dejean are yellow, a large and rather common Carabid, found in all parts of the Island. M. Chevrolat himself identified Dr. Gundlach's specimens, placing them in the genus *Cymindis*.

The dull reddish brown **Apenes parallela** Dejean, listed by Dr. Gundlach under the name *Cymindis variegata* DeJean, has since been collected by

Dr. Danforth at Coamo. The dull **Apenes pallipes** F. has been collected by Prof. J. A. Ramos at Mayagüez, Ensenada and Guánica Lagoon. **Apenes portoricensis** was described by Dr. P. J. Darlington (1939–100) from types collected at Guánica Lagoon.

Dr. P. J. Darlington described (1934–121) **Pentagonica divisa**, an exclusively endemic Carabid previously reported by Dr. Gundlach as *Rhomobodera atrorufa* Reiche, and more recently, because of yellow head and thorax and dark elytra, listed as *Pentagonica bicolor* LeConte. **Pentagonica flavipes** LeConte, which is entirely brown in color, and its variety **picipes** Darlington (1935–212) the type from Jamaica, but also in Puerto Rico, has been collected at Mayagüez and Luquillo.

Colliuris (Odacanthella) portoricensis Leibke (Mitt. Zool. Mus. Berlin, **15:** 658. 1930) was described from Puerto Rico. Both Dr. Stahl and Dr. Gundlach list as *Casnonia insignis* Chaudoir the local variety of **Colliuris rufipes** Dejean.

The holotype of **Galerita microcostata** Darlington (1934–124), a large, dull, dark purplish-brown beetle, five-eighths of an inch long, was collected at Mayagüez, but it has since been found at Quebradillas and Río Piedras.

The type of **Pseudaptinus insularis** Mutchler (1934–4), a much smaller (length 4.5 mm.), yellow brown Carabid, is also from Mayagüez, but it has since been taken at light at San Juan, Ponce and Tortuguero.

Dr. Gundlach lists **Zuphium americanum** Dejean, and there are many unlabeled specimens, handwriting of the person making the determination not recognizable, of these little black Carabids in the Río Piedras Station collection.

The brown **Brachinus brunneus** Castelnau, listed by Drs. Stahl and Gundlach as *Brachinus gilvipes* Mannerheim, has since been collected at Mayagüez, Cartagena Lagoon, Guánica and Ponce, usually at light.

Haliplidae

Dr. E. A. Schwarz identified as **Haliplus** sp., a small, oval, shining, dark brown beetle found in abundance at light, June 8, 1922, under light at Manatí.

Dytiscidae: Predaceous Water Beetles

Aquatic insects were first intensively studied in Puerto Rico by Dr. Stuart T. Danforth when making his ornithological studies at the Cartagena Lagoon. Dr. Julio García-Díaz, in his survey of fresh water insects, collected at Cartegena, Guánica and Tortuguero Lagoons, in the smaller, more inaccessible and less well known lagoons at Cabezas de San Juan: the most northeastern cape of the Island; at La Mina, or the Recreation Area on El Yunque, and in the Río Yúñez at Florida. Most recently,

the mosquito specialists of the U. S. Public Health Service, usually stationed at U. S. Army camps, and those of the local Department of Health, while collecting mosquitoes, have incidentally collected other aquatic insects.

Hydrocanthus iricolor Say is a common continental Dytiscid, 4.0 to 5.0 mm. long, which, to quote Blatchley, is "ovate, convex, attenuate behind; head, thorax and under parts reddish-yellow; elytra dark reddish-brown, polished, iridescent". Dr. Danforth found it at Cartagena, and Dr. Julio García-Díaz lists it in the "Appendix A" to his "Ecological Survey of the Fresh Water Insects of Puerto Rico" (Jour. Agr. Univ. P. R., **22** (1): 94–96. Río Piedras, April 15, 1938), collections having been made at Tortuguero.

Laccophilus proximus Say is locally a much more common species, listed by Drs. Stahl and Gundlach, collected by Dr. Danforth at Cabo Rojo and Luquillo, and by Don Julio at Cartagena and Las Cabezas de San Juan. Shortly after electric lights had been installed in the Forest Service camps on El Yunque, Dr. Luis F. Martorell in June 1935 found it attracted to these lights.

The black or very dark brown, 4.0 mm. long, **Pachydrus brevis** Sharp, **Pachydrus globosus** Aubé and **Pachydrus obniger** Chevrolat, as identified by Mr. J. A. Mutchler, were all collected and are listed by Don Julio, altho his reserve collection contains no specimens to indicate specific localities. Judging by the abundance of collections by Dr. Danforth at Mayagüez, Lajas, Cartagena Lagoon and at Humacao, *P. globosus* is the more abundant. Dr. Gundlach lists the latter under the genus *Hyphydus*. Dr. Stahl gives *Hydroporus exilis*, which may be a MS name for one of these.

A species of **Celina**, as determined by Mr. L. L. Buchanan, has been collected at light at Mayagüez.

Copelatus angustatus Chevrolat and **Copelatus posticatus** F., small Dytiscids of which the males have discs on the fore and middle tarsi, have been found in great abundance at many localities by Dr. Stuart T. Danforth. In December 1942, Dr. A. E. Pritchard collected them at Losey Field, on the south coast near Santa Isabel. Dr. Wetmore found that they had been eaten by the wood pewee and the cliff swallow. Possibly the former species is the more abundant, as it is listed by Dr. Gundlach and also by Don Julio. It was collected on Mona Island by Prof. J. A. Ramos "from a small pool near the airfield".

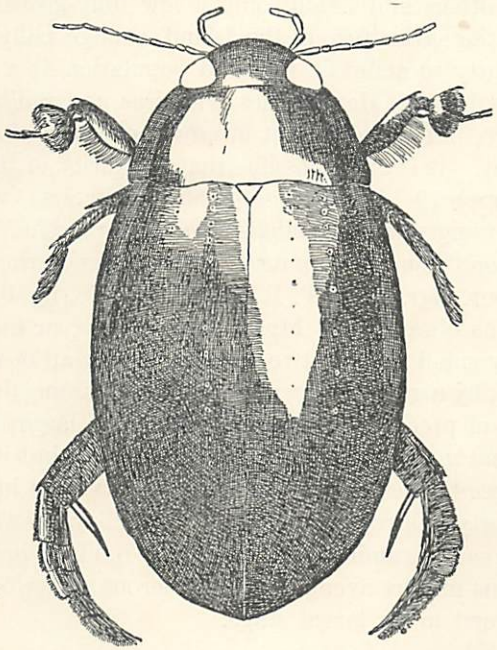
Don Julio lists **Rhantus calidus** F., as determined by Mr. A. J. Mutchler, a new record for Puerto Rico, but since found by Prof. J. A. Ramos (1947–32) on Mona Island.

Eretes stictica L., as determined by Mr. L. L. Buchanan, is an Old World species which occurs in the salt lagoons at Ensenada, Cabo Rojo and Boquerón, where it is presumably predaceous on the maggots of the

Ephydrid fly, *Ephydra gracilis* Packard, or the cosmopolitan crustacean, *Artemia salina*.

Dytiscid beetles identified by Mr. L. L. Buchanan as a species of **Pronoterus** have been collected at light at Mayagüez.

Thermonetus (*Thermonectus* or *Thermonectes* in the earlier records) **basilaris** Harris, **T. circumscripta** Latreille and **T. margineguttata** Aubé average 10.0 mm. in length and half as much in width, black marked with dull yellow, found in all parts of the Island. Dr. Gundlach lists the two



The Giant Predaceous Water Beetle, *Megadytes gigantea* Castelnau, twice natural size. (Drawn by G. N. Wolcott.)

latter under the genus *Acilius*, Dr. Wetmore notes that one had been eaten by the green heron, while all three were collected in fresh water streams by Don Julio, as well as in Cartagena, Tortuguero and the lagoons at Las Cabezas de San Juan. Prof. J. A. Ramos found *Thermonetus circunscripta* on Mona Island.

Megadytes fraterna Sharp, listed by Drs. Stahl and Gundlach under the name *Cybister laevigatus* F., is 20.0 mm. long, almost entirely black except for the lateral margins of the thorax.

Megadytes gigantea Castelnau, listed by Drs. Stahl and Gundlach as *Cybister l'herminieri* Guérin-Méneville, is almost twice as large, making it by far the largest of all the water beetles. Mostly a smooth but not

shining black, its prothorax and elythra are laterally margined with dull orange-yellow, and the hairs of its powerful hind legs are purplish. Previously not too common, the introduction of the giant Surinam toad, *Bufo marinus* L., by providing such an abundant food supply of pollywogs, in recent years has greatly increased its numbers. One sometimes notes a lily pond or other pool well stocked with the eggs of this toad, and a few days later great numbers of tadpoles, but their number very rapidly decreases until one soon finds only the ferocious larvae of this water beetle now devouring each other, and finally only a few fully-grown ones are left. Fortunately for the agriculture of the Island, enough pollywogs have survived until recently to maintain the toad population at a maximum that can be sustained by the May beetles, vaquitas and millipedes available for its sustenence, but certainly not in any pool where the larvae of this beetle are present. It is quite possible that the rarity of the native toads, *Bufo lemur* (Cope) (= *Peltaphryne gutturosus* Peters), was due to the difficulty of surviving where *Megadytes gigantea* is present. The minimum length of time for "The Development of the Giant Surinam Toad, *Bufo marinus* L." (Jour. Agr. Univ. P. R., **21** (1): 77–78, fig. 3. Río Piedras, January 1937), as observed by Mr. Francisco Seín, in the tadpole stage from egg to very small adult is two months, during all of which time it is subject to attack by a great number of enemies, including dragon fly larvae as well as those of predaceous aquatic beetles. In large bodies of water, one may hope that many will elude *Megadytes* larvae, but in small pools in which one of these beetles has laid her eggs, observation indicates that all perish. Of the fifty bullfrogs, *Rana catesbeiana* Shaw, of which Mr. Mario Pérez made stomach examinations, one large bullfrog had eaten one of these beetles, thus in part avenging the numerous pollywogs which it had doubtless consumed in its larval stage.

Gyrinidae: Whirligig Beetles

Whirligig beetles are by no means as often seen in pools and the quiet reaches of streams in Puerto Rico as in North America, but at least four species are present. From the mountains, a local subspecies, **portoricensis**, has been described by Mr. G. Ochs (Amer. Museum Novitates No. 125, pp. 8. New York, July 24, 1924) of the shining black **Dineutus longimanus** Olivier of Cuba.

The common coastal form, shining metallic, not black, **Dineutus metallicus** Aubé, was noted by Drs. Stahl and Gundlach, and has often been collected since, Don Julio having specimens from Cabezas de San Juan, Florida and Isabela.

Dineutus americanus Aubé, as identified by Mr. L. L. Buchanan, was collected in a pool near what is now Punta Borinquen Air Base by Dr. Luis

F. Martorell. The apex of its elytra is rounded, that of *D. longimanus* sharply angled.

Gyrinus rugifer Régimbart, originally described from Guadaloupe and later found in Dominica, has since been collected at Aibonito in Puerto Rico and at other places in the mountains, as well as by Don Julio at Bayamón, Florida and at Tortuguero Lagoon. It is the smallest of the whirligig beetles in Puerto Rico, only a fifth of an inch long, black with bluish and metallic reflections.

Catopidae

Dissochaetus portoricensis was described as a *Choleva* by Mr. M. H. Hatch in "Studies on the Leptodiridae (Catopidae), with description of a new species" (Jour. N. Y. Ent. Soc., **41** (1–2): 187–239, pl. 1. New York, 1933) from the type collected on El Yunque.

Limnebiidae

Uncounted millions of minute little yellowish beetles, determined by Dr. E. A. Schwarz as a species of **Ochthebius**, were flying about in the early morning of February 14th, 1913 at Santa Isabel, and Dr. Stuart T. Danforth in November 1930 made comparable collections at Cabo Rojo.

Ptiliidae

Despite the minute size of Ptiliid beetles, the intensive intercepting of Mr. R. G. Oakley at Ponce adds the record of **Acratrichis haldemanni** LeConte, as determined by Mr. H. S. Barber, on *Inga vera*, and this or other species on dung and in rotten cacao pods at Mayagüez to the Leng & Mutchler record of **Acratrichis atomaria** DeGeer.

Scydmaenidae

From both St. Thomas and Puerto Rico are recorded the very small, shining, oval, convex Scydmaenid beetles: **Euconnus amoenus** Reitter, **Euconnus coralinus** Reitter, **Euconnus tantillus** Reitter and **Euconnus testaceous** Schaum. Mr. R. G. Oakley intercepted one of these at Villalba.

Pselaphidae

Herr Edm. Reitter in "Beitrag zur Kentniss der Clavigeriden, Pselaphiden und Scydmaeniden von Westindien" (Deutsche Ent. Zeitschr., **27** (1): 33–46. Berlín, 1883) describes as *Trimiopsis*: **Melba eggersi, Melba parmata** and **Melba ventricosa**, of which the types were collected in Puerto Rico.

M. Ch. Aubé in his "Revision de la Familie des Pselaphiens" (Ann. Soc.

Ent. France, 2 Serie, 2: 120. Paris, 1844) describes **Reichenbachia eucera** from the type collected in Puerto Rico.

Scaphidiidae

Mr. H. G. Barber determined a small beetle intercepted by Mr. R. G. Oakley in decaying wood at Añasco as a species of **Scaphosoma**.

Staphylinidae

Dr. Richard E. Blackwelder in his "Monograph of the West Indian Beetles of the Family Staphylinidae" (Bulletin No. 182, U. S. National Museum, pp. 658, fig. 3, maps 19, bibliography. Washington, D. C., 1943) records 103 Staphylinids from Puerto Rico, 3 from Vieques, one from Culebra and one from Mona. Prof. J. A. Ramos found a *Xantholinus* on fresh cow dung on Mona, and also "numerous small undetermined Staphylinids on fungi at Sardinera Beach". The Puerto Rican species are:

1. *Piestus penicillatus* (Dalman)
   (as *erythropus* Erichson) Stahl IP & IB
   Blackwelder 43-46: at Utuado and on El Yunque.
2. *Phloeonomus pedicularius* Erichson (as *Omalium*) 40-887: TYPE from Puerto Rico
   (as *Omalium*) Leng & Mutchler IP & IB
   Blackwelder 43-52: no new records from PR.
   (as sp.—det W. S. Fisher) larvae and adults on gummy exudate from aceitillo, *Zanthoxylum flavum*, at Guánica (148-40, 79-40).
3. *Carpelimus fulvipes* Erichson (as *Trogophloeus*) 40-804: TYPE from Puerto Rico
   (as *Trogophloeus aequalis* J. Duval) Gundlach 93-100
   (as *Trogophloeus*) Leng & Mutchler IP & IB
   Blackwelder 43-62: from Isabela (WAH), Jayuya (Oakley), Bayamón (Mills), Maricao, Guanica and Cartagena Lagoon.
4. *Carpelimus correctus* Blackwelder 43-64: at Maricao.
5. *Carpelimus borinquensis* Blackwelder 43-70: TYPE from Maricao Insular Forest, others from El Yunque, P. R. (Darlington).
6. *Carpelimus danforthi* Blackwelder 43-71: TYPE from under rubbish on muddy bank of Guánica Lagoon, others at Ensenada, P. R.
7. *Carpelimus imitator* (Bierig)
   Blackwelder 43-72: at Utuado (Busck), Jayuya (Oakley), Guánica (Darlington), Maricao and Mayagüez.
8. *Carpelimus aridus* (DuVal)
   (as *Trogophloeus*) Gundlach IP & IB
   Blackwelder 43-73: at Guánica.
9. *Carpelimus petomus* Blackwelder 43-76: at Guánica, P. R., and from Vieques Id. (Leonard).
10. *Carpelimus flavipes* (Erichson)
    Blackwelder 43-77: at Guánica and Mayagüez, P. R.

11. *Carpelimus scrobiger* (Cameron)
Blackwelder 43-76: from Vieques Id. (Busck), and at Aguadilla and Utuado, P. R. (Busck).
12. *Oxytelus insignitus* Gravenhorst
Blackwelder 43-92: at Aguadilla (Busck), Ponce (Dozier), Matrullas, Maricao, Villalba, Mayagüez and San Juan, P. R.
13. *Oxytelus incisus* Motschulsky
Blackwelder 43-96: at sixteen Puerto Rican localities.
14. *Oxytelus eremus* Blackwelder 43-98: TYPE from Guanajibo (Mayaguez), Puerto Rico (Dozier).
15. *Oxytelus scorpio* Fauvel
Blackwelder 43-99: at Maricao.
16. *Thinobius nitidulus* Bernhauer
Blackwelder 43-109: on El Yunque (Darlington).
17. *Platystethus spiculus* Erichson
Blackwelder 43-110: at Ponce (Dozier), Hormigueros, Humacao and San Juan, P. R.
18. *Bledius beattyi* Blackwelder 43-117: from Vieques Id. (Leonard).
19. *Pseudolispinodes danforthi* Blackwelder 43-125: TYPE from under bark of rotting logs at Mayagüez, P. R.
20. *Pseudolispinodes tenellus* Erichson (as *Lispinus*) 40-830: TYPE from St. John and Puerto Rico.
Blackwelder 43-126: on El Yunque.
21. *Lispinus laticollis* Erichson
Fauvel 63-442. Leng & Mutchler IP & IB
Blackwelder 43-131: no new P. R. records.
22. *Lispinus attenuatus* Erichson 40-828: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-134: on El Yunque (Darlington) and at Mayagüez.
23. *Lispinus insularis* Fauvel
Blackwelder 43-136: at Fajardo (Busck).
24. *Espeson moratum* Schaufuss
Blackwelder 43-146: on El Yunque (Darlington).
25. *Thoracophorus simplex* Wendeler
Blackwelder 43-149: at Adjuntas and Mayagüez.
26. *Thoracophorus brevicristatus* (Horn)
Blackwelder 43-150: at Mayaguez.
27. *Thoracophorus guadalupensis* Cameron
Blackwelder 43-151: at Mayaguez.
28. *Thoracophorus denticollis* Erichson (as *Glyptoma*) 40-910: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-154: no new records from Puerto Rico.
29. *Paralispinus exiguus* Erichson (as *Lispinus*) 40-830: TYPE from Puerto Rico.
(as *Ancaeus*) Leng & Mutchler IP & IB
Blackwelder 43-158: at Mayaguez.
30. *Paralispinus crepusculus* Blackwelder 43-160: at Fajardo (Busck).
31. *Paralispinus punctatus* Blackwelder 43-161: TYPE from El Yunque, Puerto Rico (Darlington).

32. *Neotrochus cylindrus* Erichson (as *Holotrochus*) 40-758: TYPE from Puerto Rico.
(as *Holotrochus*) Leng & Mutchler, IP & IB
Blackwelder 43-167: no new records from Puerto Rico.
33. *Holotrochus volvulus* Erichson 40-758: TYPE from Puerto Rico.
Blackwelder 43-171: from El Yunque (Darlington), and at Ponce and Adjuntas (Oakley). in dung
(as sp.) in rotten wood at Mayagüez (I. No 6361), at Añasco (I No 6238).
34. *Mimogonus fumator* (Fauvel)
Blackwelder 43-172: at Lajas (Dozier) and at Juana Díaz (Oakley), also intercepted at New York in soil from Puerto Rico.
35. *Osorius laeviceps* Notman, Howard, "A synoptic Review of the Beetles of the Tribe Osoriini from the Western Hemisphere." Proc. U. S. Nat. Museum, *67* (11): 1–26. Washington, D. C., 1925: TYPE from San Juan, Puerto Rico.
Blackwelder 43-195: from El Yunque (Darlington), and at Adjuntas, Maricao and Mayagüez.
36. *Osorius eggersi* Bernhauer
Blackwelder 43-196: one record from Puerto Rico.
37. *Lithocharis sororcula* Kraatz
Blackwelder 43-241: at Lajas and Boquerón (Dozier), San Juan and Salinas
38. *Lithocharis ochracea* (Gravenhorst)
Gundlach IP & IB
Blackwelder 43-242: at Lajas, Guánica and Ponce (Dozier), at San Juan and Salinas.
39. *Lithocharis secunda* Blackwelder 43-244: at Salinas.
40. *Lithocharis volans* Blackwelder 43-245: at Salinas.
41. *Lithocharis limbata* Erichson
Blackwelder 43-246: at Villalba, Mayagüez and San Juan.
42. *Lithocharis dorsalis* Erichson 40-616: TYPE from Puerto Rico.
Leng & Mutchler. IP & IB
Blackwelder 43-247: at San Germán (Dozier), at Villalba, Maricao and Adjuntas.
43. *Lithocharis posticata* Erichson 40-619: TYPE from Puerto Rico.
Leng & Mutchler. IP & IB Blackwelder 43-249: no new record.
44. *Aderocharis suturalis* Blackwelder 43-254: TYPE from horse manure and flying at dusk near Villalba, Puerto Rico, others from Ensenada (Dozier) and Adjuntas.
45. *Stilomedon audanti* Blackwelder 43-258: At Ponce, P. R. (Dozier).
46. *Sunius oakleyi* Blackwelder 43-261: TYPE from rotten stump at Adjuntas, Puerto Rico, others from Maricao Insular Forest and on El Yunque (Darlington).
47. *Scopaeus fasciatellus* Erichson 40-609: TYPE from Puerto Rico.
Leng & Mutchler IP & IB Blackwelder 43-283: at Ciales.
48. *Scopaeus antennalis* Cameron
Blackwelder 43-284: at Jayuya (Oakley).
49. *Scopaeus pygmaeus* Erichson 40-608: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-287: at Jayuya (Oakley) and at Guánica.

50. *Rugilus chthonus* Blackwelder 43-304: TYPE from dead leaves at Villalba, Puerto Rico.
51. *Lathrobium subterraneum* Blackwelder 43-311: TYPE from ground cover at El Yunque, Puerto Rico (Darlington).
52. *Lobrathium borinquense* Blackwelder 43-319: TYPE in ground cover at El Yunque, Puerto Rico (Darlington).
53. *Homoeotarsus albipes* (Erichson) 40-566 (as *Cryptobium*): TYPE from Puerto Rico.
    (as *Cryptobium*) Leng & Mutchler IP & IB
    Blackwelder 43-328: at Bayamón (Lesesnes).
54. *Biocrypta fulvipes* (Erichson) 40-566 (as *Cryptobium*): TYPE from Puerto Rico.
    (as *Cryptobium*) Leng & Mutchler IP & IB
    Blackwelder 43-337: on El Yunque and in Maricao Insular Forest (Darlington), and at Villalba, from damp leaves.
55. *Stilosaurus lineatus* Blackwelder 43-349: TYPE from El Yunque, Puerto Rico (Darlington).
56. *Stamnoderus labeo* (Erichson)
    Blackwelder 43-352: on El Yunque (Darlington) and at Villalba.
57. *Stiliphacis exigua* (Erichson) (as *Sunius exiguus*) 40-647: TYPE from Puerto Rico.
    (as *Stilicopsis*) Leng & Mutchler IP & IB: on cucumbers at Jayuya, (I No 3735 det. as "sp." E. A. Chapin).
    Blackwelder 43-356: no new record from Puerto Rico.
58. *Pinophilus danforthi* Blackwelder 43-378: TYPE from Humacao, Puerto Rico (Miguel A. Díaz).
59. *Pinophilus bierigi* Blackwelder 43-382: TYPE from Mayagüez, Puerto Rico (A. Suro).
60. *Pinophilus flavipes* Erichson 40-674: TYPE from Puerto Rico.
    Leng & Mutchler. IP & IB Danforth: at Humacao xi–30 det. Mutchler.
    Blackwelder 43-383: no new records from Puerto Rico.
    Pinophilus latipes Gravenhorst/Gundlach Stahl IP & IB
61. *Palaminus bifidus* Notman 29-14: TYPE from El Yunque, others from Aibonito and Adjuntas, P. R. IB Blackwelder 43-389: no new record.
62. *Palaminus grandicollis* Notman 29-16: TYPE from Aibonito, other from Adjuntas, P. R.
    IB Blackwelder 43-390: no new record.
63. *Palaminus insularis* Cameron
    Notman 29-17: at Aibonito. IB Blackwelder 43-390: no new record.
64. *Palaminus lengi* Notman, Howard, "New Species of *Palaminus* from the West Indies, together with a Synoptic Review of the Genus." Amer. Museum Novitates No. 386, pp. 17. New York, November 27, 1929: TYPE from Adjuntas, P. R.
    Blackwelder 43-391: at Mayagüez (Dozier) and Adjuntas (Oakley).
65. *Palaminus parvipennis* Notman 29-14: TYPE from El Yunque, P. R., others from Loíza.
    Blackwelder 43-391: from Mayagüez (Dozier) and Villalba.
66. *Palaminus procerus* Notman 29-16: TYPE from Aibonito, P. R.
    IB Blackwelder 43-392: from Maricao (Morrison).

67. *Palaminus pusillus* Notman 29-15: TYPE from El Yunque, P. R.
IB Blackwelder 43-392: "only the unique type."
68. *Palaminus scitulus* Notman 29-15: TYPE from Aibonito, P. R.
IB Blackwelder 43-392: "only the two types."
69. *Palaminus variabilis* Erichson 40-683: TYPE from Colombia, Puerto Rico and St. Thomas.
Blackwelder 43-393: no new records from Puerto Rico.
70. *Paederomimus lustralis* (Erichson) (as *Philonthus*) 40-489: TYPE from Puerto Rico.
Leng & Mutchler IP & IB Blackwelder 43-398: no new records.
71. *Philonthus hepaticus* Erichson
Blackwelder 43-401: at Guánica (Smyth), at Lajas and Hormigueros (Dozier), and at Maricao, Adjuntas and San Juan.
common in and under both stale and fresh cow droppings, at Guánica (545-13).
72. *Philonthus thermarum* Aubé
Blackwelder 43-403: at Lajas, Guánica, Sabana Grande and Boquerón (Dozier), and at Maricao.
73. *Philonthus ventralis* (Gravenhorst)
Blackwelder 43-404: at Lajas, Ensenada and Juana Díaz (Dozier), from Culebra Id. (Busck), and at Guánica, Cartagena Lagoon, Adjuntas, Humacao, Mameyes and San Juan in Puerto Rico.
74. *Philonthus discoideus* (Gravenhorst)
Blackwelder 43-407: at San Juan.
75. *Philonthus figulus* Erichson
Blackwelder 43-409: at Maricao.
76. *Philonthus longicornis* Stephens
Blackwelder 43-410: at Lajas (Dozier).
77. *Philonthus havaniensis* (Laporte)
(as *P. trepidus*) Erichson 40-489: TYPE from Puerto Rico and St. John.
Leng & Mutchler IP & IB
Blackwelder 43-418: at Guánica, Maricao and Mayagüez.
Philonthus alumnus Erichson
Leng & Mutchler IP & IB IB Sup-85: (as "Sp.") in cacao pods at Mayaguez (I No. 6370), and in guavas (I No. 6381); at light at Palo Saco (I No. 6564).
78. *Belonuchus oakleyi* Blackwelder 43-422: TYPE "in a mass of rotting fruit" at the base of an imported palmlike tree at Mayagüez. Puerto Rico.
79. *Belonuchus gagates* Erichson 40-424: TYPE from Puerto Rico.
Leng & Mutchler IP & IB: on orange fruit at Ponce (I No. 2659).
Blackwelder 43-424: at Bayamón (Busck), Juana Díaz, Ensenada and Mayaguez (Dozier), and at Maricao, Mayagüez, San Juan and on El Yunque.
80. *Belonuchus danforthi* Blackwelder 43-429: TYPE from rotting guava fruit at Maricao, Puerto Rico.
81. *Cafius subtilis* Cameron
Blackwelder 43-436: at San Juan under seaweed and drift on sandy beaches.

82. *Cafius caribeanus* Bierig
Blackwelder 43-437: at San Juan and Humacao under seaweed.
83. *Cafius bistriatus* (Erichson)
Blackwelder 43-438: at San Juan under seaweed, and from Mona Id. (Hoffman).
84. *Erichsonius humilis* Erichson 40-512 (as *Philonthus*): TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-441: at Jayuya (Oakley).
85. *Diochus nanus* Erichson
Blackwelder 43-455: at Maricao.
86. *Holisus debilis* Erichson
Blackwelder 43-461: on El Yunque.
87. *Holisus guildingii* Erichson
Blackwelder 43-462: at Mayagüez and on El Yunque.
88. *Atanygnathus laticollis* (Erichson)
Blackwelder 43-472: at Mayaguez.
89. *Xantholinus oakleyi* Blackwelder 43-476: TYPE in dung and manure, 13 miles east of Maricao, other from Villalba.
90. *Xantholinus attenuatus* Erichson 39-330: TYPE from St. Thomas and Puerto Rico.
Leng & Mutchler Merrill 15-54: in fresh cow dung.
(as sp.) Wolcott 24-17, 29: eaten by *Anolis pulchellus* and *A. cristatellus*.
Blackwelder 43-478: twenty-three records from Puerto Rico.
at Guánica (545-13 det. E. A. Schwarz, confirmed R. E. Blackwelder).
91. *Xantholinus humeralis* Erichson
Blackwelder 43-479: at San Germán (Dozier) and Maricao.
92. *Xantholinus illucens* Erichson
Blackwelder 43-488: at thirteen Puerto Rican localities.
93. *Leptacinus parumpunctatus* (Gyllenhal)
Blackwelder 43-494: at Lajas and Yauco (Dozier).
94. *Leucoparyphus silphoides* (Linnaeus)
Blackwelder 43-510: at Salinas.
95. *Coproporus apicalis* (Erichson) 39-250 (as *Tachinus*): TYPE from Puerto Rico.
(as *Erchomus apicalis*) Leng & Mutchler IP & IB
Blackwelder 43-514: no new records from Puerto Rico.
96. *Coproporus hepaticus* (Erichson)
(as *Cilea*) Leng & Mutchler IP & IB
Blackwelder 43-514: at Cayey (Cotton), Bayamon (Lesesne), and San Juan.
under bark of decaying bucare trees at Cayey (307-17 det. R. E. Blackwelder).
97. *Coproporus flavicollis* Scriba
(as *Tachinus nitidulus*) Erichson 39-247: TYPE from Puerto Rico.
(as *Erchomus nitidulus*) Leng & Mutchler IP & IB
Blackwelder 43-518: no new record from Puerto Rico.

98. *Coproporus ebonus* Blackwelder
(as *Tachinus piceus*) Erichson 39-246, 250: TYPE from Puerto Rico.
(as *Erchomus piceus*) Leng & Mutchler IP & IB
Blackwelder 43-519: at Adjuntas.

99. *Coproporus pulchellus* (Erichson) 39-247 (as *Tachinus*): TYPE from Puerto Rico.
(as *Cilea*) Leng & Mutchler IP & IB
Blackwelder 43-520: no new Puerto Rican record.
in guavas at Mayaguez (I No. 6383 det. E. A. Chapin).

100. *Coproporus rutilus* (Erichson) 39-522 (as *Tachinus*): TYPE from Puerto Rico.
(as *Cilea*) and (as *Coproporus terminalis* Erichson), not in synonymy Leng & Mutchler IP & IB
Blackwelder 43-522: at Ponce (Oakley).

101. *Conosomus interruptus* (Erichson)
Blackwelder 43-525: on El Yunque (Darlington).

102. *Bryoporus obscurus* (Erichson) 39-272 (as *Bolitobius*): TYPE from Puerto Rico.
(as *Bolitobius*) Leng & Mutchler IP & IB
Blackwelder 43-529: no new record from Puerto Rico.
Gyrophaena sp.—det. E. A. Schwarz
IP & IB: common on a fungus, *Daedalea amanitoides* (1221-13).
at Mayagüez (I No. 6371); in cacao pods at Mayagüez (I No. 6378).

103. *Atheta decipula* (Erichson) 39-119 (as *Homalota*): TYPE from Puerto Rico.
Blackwelder 43-551: no new record.

104. *Atheta melanura* Erichson 39-117 (as *Homalota*): TYPE from Puerto Rico.
Blackwelder 43-553: no new record.

105. *Hoplandria terminata* Erichson 39-130 (as *Homalota*): TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-557: no new record.

106. *Phloeopora religata* (Erichson) 39-79: TYPE from Puerto Rico.
Blackwelder 43-558: no new record.
Aleochara sp. nov.—det. E. A. Schwarz
in cow dung at Guanica (GBM).

Hydrophilidae: Water Scavenger Beetles

Hydrochus pallipes Chevrolat, listed by Dr. Gundlach and found by Dr. Wetmore to have been eaten by the tody, has not since been collected.

The dark brown **Berosus interstitialis** Knisch (= *B. tesselatus* F. & S.) and the light brown, spotted, 5.0 mm. long **Berosus guadeloupensis** Fletiaux & Sallé, Dr. Wetmore found eaten not only by the tody, but also by the cliff swallow, the blue heron and sandpipers. The former is presumably somewhat more abundant, as Dr. Danforth has specimens from Cartagena Lagoon, Cabo Rojo, Añasco, Coamo and Tortuguero; Dr. A. E. Pritchard from the swamps near Santa Isabel, and Prof. J. A. Ramos from Mona Island. Don Julio reports both species of the latter, as identified by Mr.

A. J. Mutchler, of which large numbers were found in the pools at Isabela, Dr. Danforth had specimens from Mayaguez and Rio Piedras.

The smooth, shining, oval, black **Tropisternus lateralis** F. (= *T. nimbatus* Say), 8.5 mm. long, its thorax and elytra narrowly margined with yellow, was listed by Drs. Gundlach and Stahl, and found by Dr. Wetmore to form part of the food of the little blue heron. Many collections were made by Dr. Danforth; Dr. Pritchard found it in the swamps around Santa Isabel, and it is listed by Don Julio, whose collection contains hundreds of specimens: from chacras at Isabela, from Guánica and Cartagena Lagoons and those at Las Cabeẓas de San Juan. It occurs not only on Culebra and Mona Islands, but also in the most of the other Antilles, and continentally from New York to the Argentine.

Tropisternus chalybeus Castelnau, as identified by Mr. W. S. Fisher, is represented by a single specimen collected at light at San Juan.

Tropisternus collaris F., with striped elytra, was listed by Drs. Gundlach and Stahl. Dr. H. L. Van Volkenberg, while working as Parasitologist at the Mayagüez Station in 1930 and 1931, discovered that this beetle was the host of a tapeworm cysticercoid, and of the thorny-headed worm, *Macracanthorhynchus hirudinaceus*, of swine. It is a common aquatic beetle in Puerto Rico, collected at many points by Dr. Danforth and Don Julio, but present also in the other Antilles and continentally from Mexico to the Argentine.

Neohydrophilus medius Brullé (= *N. tenebrioides* DuVal) and **Neohydrophilus phallicus** d'Orchymont are similar, smooth, shining black beetles, averaging five-eights of an inch in length. Drs. Gundlach and Stahl reported the former as a *Hydrous*, and Dr. Wetmore found them eaten by the little blue heron. Individuals fly to lights, but most collections have been made in lagoons, pools or streams. One species, presumably the former, has two punctures on the prothroax; that of the other is impunctate.

Largest of all the Hydrophilidae is **Hydrophilus insularis** Castelnau, almost an inch and a half in length, equaling in length *Megadytes gigantea* Castelnau, but considerably slimmer, and with even more highly polished black elytra. Not especially abundant, it was listed by Drs. Gundlach and Stahl, and is found on Mona as well as in most of the Antilles and continentally from Texas to the Argentine.

Much more abundant and decidedly smaller, but otherwise similar in appearance, is **Hydrophilus ater** Olivier, a continental form, of which the subspecies **intermedius** DuVal only is found in the Antilles. Dr. Wetmore notes that it had been eaten by the little blue heron, and Mrs. Raquel Dexter, by the introduced toad. Leng & Mutchler report it from Culebra

Island as a *Stethoxus*, and it has also been identified as a *Hydrous*, but Drs. Stahl and Gundlach list it under the at present preferred name.

Mr. Hugh B. Leech identifies as **Helochares rufobrunneus** Balfour-Browne "a plain dark brown beetle, like a large Enochrus; 7.0 mm. long; no elytral striae and virtually impunctate", of which numerous adults came to light at Río Piedras on May 20th, 1943. It has not been previously reported from Puerto Rico.

As *Philhydrus melanocephalus* F., Dr. Gundlach reports what is presumably the little brown, 3.0 mm. long **Enochrus ochraceus** Melsheimer, of which Don Julio's collection contains specimens from the streams on El Yunque and hundreds from Cartagena Lagoon. Or, it may refer to the much more common **Enochrus nebulosus** Say, of which Dr. Danforth has specimens from all parts of the Island, and Prof. J. A. Ramos (1947–32) many from Mona. Dr. Wetmore reports these beetles as being eaten by the killdeer.

Phaenonotum estriatum Say is a very convex, small, shining, dark reddish-brown beetle, 3.0 mm. long, sometimes coming to light, and in the field found in abundance in cane trash, and also in decaying fig fruits. As it was noted as an item in the food of the crested and the small yellow grass lizards, presumably it is in reality much more abundant than the scarcity of collection records would indicate.

Dactylosternum flavicorne Mulsant is listed by Drs. Stahl and Gundlach as a *Cyclonotum*. Leng & Mutchler list **Dactylosternum advectum** Horn, and Mr. A. J. Mutchler identified for Dr. Danforth numerous specimens of **Dactylosternum picicorne** Mulsant from Yabucoa, Ponce, Luquillo, Río Piedras and Mayagüez.

Dactylosternum abdominale F. is apparently the common species in Puerto Rico: 4.0 mm. long, and almost as broad, a reddish-brown to almost black beetle with very marked elytral striae. It is an item in the food of the lizards in the mountains, where it occurs under the bark of trees, in decaying figs, in decaying cacao pods and in the trash of banana plants.

In the course of his fresh water insect survey, Don Julio García-Díaz collected **Phaenotypus palmarum** Schwarz, and also **Paracymus subcupreus** Say, both identified by Mr. A. J. Mutchler, the latter with some doubt, all specimens being retained by him. Both are new records for Puerto Rico.

Dr. Wetmore reports a species of **Cercyon** eaten by a cliff swallow, and Prof. J. A. Ramos found one at light on Mona Island. Recent interceptions made in dung at Adjuntas and in rotten cacao pods at Mayagüez have been re-identified as species of **Pelosoma** not *Oösternum costatum* Sharp, as previously reported.

Monoedidae

Mr. W. S. Fisher identified as a species of **Monoedus** a small beetle intercepted by Mr. R. G. Oakley on chinaberry tree at Adjuntas.

Histeridae: Hister Beetles

The small, hard, black shining Hister beetles, usually tending to be round and flattened, are supposed to have derived their name from the Latin word histrio, meaning clown or mimic. The best known member in Puerto Rico is an introduced East Indian species, **Plaesius javanus** Erichson, which is predaceous on the immature stages of the banana corm weevil, *Cosmopolites sordida* Germar. In captivity in Puerto Rico, the adult Histerids fed on both larvae and pupae of the introduced pest of bananas, but no trace has since been found to indicate that any survived of those released in a banana grove at Adjuntas.

Including its prominent projecting jaws, **Hololepta 4-dentatum** F. is 11.0 mm. long, making it possibly the largest local Histerid in Puerto Rico. Hardly half the abdomen is covered by the transversely truncate elytra, which have basaly two lateral striae. Dr. Richard T. Cotton found it abundant under the bark of dead bucare trees at Cayey, and it has since been collected at Mayagüez. As *Lioderma ruptistriata* Marseul, Dr. Gundlach listed **Hololepta interruptum** Marseul, a somewhat smaller but brightly polished species, which Dr. Cotton collected under the bark of bucare trees, and also in grapefruit groves.

Of **Acritus analis** Leconte, Dr. Gundlach writes, "muy pequeña (no pasa de 1.0 mm. en longitud)". It has since been identified by Dr. E. A. Schwarz from specimens found in cow dung at Guánica.

Carcinops dominicana Marseul is a small metallic green beetle, collected by Dr. R. T. Cotton under bark of bucare trees at Cayey. **Carcinops troglodytes** Paykull, listed by Dr. Gundlach, has not since been found locally.

Prof. J. A. Ramos (1947–32) reports collecting on dead birds on Sardinera Beach, Mona Island, "numerous small, black, shining undetermined histerids", which have since been identified by Mr. H. S. Barber as species of **Saprinus.**

Types of **Epierus antillarum**, collected in Puerto Rico, Hispaniola and Cuba were described by S. A. de Marseul in his "Essai Monographique sur la Familie des Histerides" (Ann. Soc. Ent. France, Series 3, **2:** 671–707. Paris, 1854), in which is listed his **Epierus waterhousei** from Puerto Rico.

From material sent him by Dr. Gundlach, M. de Marseul named after Herr Leopoldo Krug what most unfortunately was mis-spelled **Omalodes klugi**: a large, almost circular Histerid, repeatedly collected since in the mountains back of Mayagüez by Dr. Danforth and his students, dozens being found in decaying bananas at Maricao. Prof. J. A. Ramos has a single specimen from Mona Island. Other specimens of what may be the same species, some of which were identified by Dr. E. A. Schwarz as **Omalodes ruficlavis** Marseul have been found under bark of decaying

bucare trees at Cayey, in coffee groves at Villalba and at El Verde (Río Grande), in grapefruit grove at Manatí, and in flight or at light at Guánica and Salinas. They vary in size from 6.0 to 8.0 mm. long, usually so highly polished that they look as tho they might be sticky to touch.

The elytra of beetles belonging to the genus Hister normally have nine striae. Mr. H. S. Barber has identified as **Hister confinis** Erichson, 3.0 mm. long, and as **Hister coenosus** Erichson, 5.0 mm. long, the less shiny beetles collected in dung in numerous localities of Puerto Rico.

Lucanidae: Stag Beetles

Paxillus pentaphyllus Palisot de Beauvois, an inch long, and quarter of an inch wide, is a flattened, reddish-brown to black beetle, with stout antennae, the outer segments of which are "leaf-like, but not capable of being opposed or folded together into a compact club,—therefore pectinate, or comb-toothed, rather than lamellate" according to Blatchley. It occurs most often in the mountains, the larvae living in rotten wood, all sizes being found, together with adults, in logs that have reached just the right stage of decay. This was one of the insects first noted in Puerto Rico, by the Botanist Ledru in 1780.

Ledru also listed as *Passalus dentatus* Fabricius what is now called **Paxillus puncticollis** Serville, another member of the family later collected by Dr. Gundlach in the western end of the Island.

Paxillus crenatus MacLeay is smaller and more convex, with similar habits and habitat, but present also in the Luquillo Mountains.

Scarabaeidae: Lamellicorn Beetles

Despite several attempts to introduce and establish coprophagid or dung-rolling beetles, to dispose promptly of fresh cow dung so that it would not serve as host for horn-fly larvae, no representative of any of the introduced species has been found here since release. Shortly after the establishment of the Sugar Producers' Experiment Station at Río Piedras, Mr. J. D. Mitchell of Victoria, Texas, sent 275 adult beetles, of which 146 arrived in Porto Rico alive, of three species: *Canthon ebenus* Say, *Canthon laevis* Drury and (what is now known as) *Ateuchus lecontei* (Harold) (originally identified as a *Choeridium* by Dr. W. Dwight Pierce). About a hundred beetles of *Canthon violaceus* Olivier were brought from Santo Domingo by G. B. Merrill, and 8 adults of *Copris carolina* Linn. were sent by the writer from Randolph, Illinois. These beetles were kept in large outdoor screen cages at Guánica, supplied with fresh cow dung daily and they multiplied rapidly in confinement. When the cages became crowded, a liberation of 100 adults at a time would be made. Although the condi-

tions seemed favorable for these beetles, especially those from south Texas and southern Santo Domingo, yet none was noticed in the field after their release, and it is doubtful if any became permanently established in Puerto Rico" ("Insect Parasite Introduction in Porto Rico", Jour. Dept. Agr. P. R., **6** (1): 5–20, fig. 7. San Juan, October 1922). Many years later, additional attempts at establishing dung-beetles from Santo Domingo were made by Dr. H. L. Dozier at Mayagüez, with the same lack of success.

Despite failure of coprophagid beetles from a similar xerophytic environment to become established in southwestern Puerto Rico, native species do occur on the Island, but apparently only in the mountains. Mr. R. G. Oakley, a very keen collector of hitherto unknown insects, when stationed at Ponce as representative of the Federal Horticultural Board, found five new species of such beetles, one of which Dr. Chapin named after him. Ragged by other Plant Quarantine Inspectors stationed at that time in Puerto Rico about having a dung-beetle bearing his name, he requested Dr. Chapin to name the next one he found after one of his tormentors. Unfortunately, the scheme somewhat misfired, as Oakley referred to C. G. Anderson only by his nickname: "Andy", therefore the beetle is **Canthochilum andyi.**

Canthonella parva, described by Dr. E. A. Chapin as the sole known representative of "*Canthonella*, a new Genus of Scarabaeidae (Coleoptera)" (American Museum Novitates No. 409, pp. 2. New York, March 18, 1930), with the type from Coamo Springs, others from Adjuntas, is characterized as being "almost blue-black, the pale spot on the elytron . . . humeral, and the pronotum . . . strongly, densely and moderately coarsely punctate. Length 3.0 mm." Prof. J. A. Ramos has found it under dead leaves in the Maricao Forest.

The type of **Canthochilum oakleyi,** described by Dr. E. A. Chapin as representing "A New Genus and Species of Dung-Inhabiting Scarabaeidae from Puerto Rico, with Notes on the Coprinae in the Greater Antilles (Coleoptera)" (Proc. Biological Soc. Washington, **47:** 99–101. Washington, D. C., June 13, 1934), was found under dung at Adjuntas, others at Aibonito and in the mountains north of Yauco.

The type of **Canthochilum andyi** Chapin ("New Species of Scarabaeidae (Coleoptera) from Puerto Rico and the Virgin Islands" Jour. Agr. Univ. P. R., **19** (2): 67–71. San Juan, October 15, 1935), from Matrullas Dam, near Orocovis, was found under dung, and that of **Canthochilum hispidum** Chapin (1935–67) was from Villalba. The former is piceous to deep black, 5.55 mm. long, the latter with a vestiture of capitate hair and "almost completely covered with a layer of dirt most difficult to remove." Specimens of **Canthochilum histeroides** Harold were intercepted by Mr. R. G.

Oakley at the Pietri finca, Adjuntas, and at Werscheling finca, Ponce, all in or under dung. It is doubtful if any of these is large enough, or occurs in sufficient numbers to be of any appreciable economic importance.

Saprosites blackwelderi, described by Dr. E. A. Chapin (1940–11), the type from rotten wood at Mayagüez, others from Añasco, is 3.0 mm. long, "moderately convex-cylindrical, pronotum slightly wider than elytra at base; castaneous with margins of pronotum and elytra darker."

In xerophytic Puerto Rico, the beetles which are very abundant and notably active in tunneling thru and aerating fresh cow-dung are the oval, shining, yellowish-brown **Aphodius lividus** Olivier, characterized by prothorax and elytra laterally margined by lighter yellowish-brown. This cosmopolitan beetle occurs in all parts of the Island, even the most humid, and in the absence of fresh cow dung may be found living under filter-press cake or "cachaza" from the sugar Centrals. Not recorded by Dr. Gundlach, it may be presumed to have been introduced rather recently thru the agency of commerce in importing live domestic animals from the United States. Dr. Chapin states that "to judge from the fact that *Aphodius lividus* (Olivier) is now generally established from the northern United States to the South Sea Islands, and completely around the world in the tropics and subtropics, climate will play a minor role among the distributional factors." Even at the time that Dr. Wetmore was making his studies on the food of birds in Puerto Rico, it presumably was not common here, for he reports finding it only amid the stomach contents of the ani.

Less abundant in Puerto Rico, smaller and entirely light brown is **Aphodius cuniculus** Chevrolat (= *A. guadeloupensis* F. & S.), specifically recorded from Vieques and the larger Virgin Islands, and noted as "common at light" on Mona Island by Prof. J. A. Ramos, it occurs widely from Mexico to Central America. Some species of *Aphodius* was indicated by Mr. J. A. Stevenson (1915–20) as being attacked by the Green Muscardine fungus, *Metarrhizium anisopliae.* The record of *Aphodius granarius* Linn. from Puerto Rico, recorded by Mr. G. B. Merrill (1915–54) as found in cow manure, is in error, as is also that of this species being eaten by the little grass lizard, *Anolis pulchellus*, altho other species are eaten by these lizards.

In any extensive collection of the beetles found tunneling thru fresh cow dung in Puerto Rico, usually about half are the light yellowish-brown *Aphodius lividus* Olivier, but most of the remainder are a large black species of *Ataenius*, 4.7 to 5.5 mm. long, previously called *Ataenius cognatus* LeConte. Subsequently re-described as *Ataenius darlingtoni* Hinton (1937) from Puerto Rico and St. Croix, it is now considered the "equal of *salutator* Fall (1930), described from Florida. This synonymy was published by Cartwright in Bulletin of the Brooklyn Entomological Society

40: 47 (1945)," according to Dr. E. A. Chapin. Prof. J. A. Ramos found a single specimen of **Ataenius salutator** Fall at light on Mona Island.

Equally large, or larger, and also black is **Ataenius stercorator** F., under which name are recorded the finding by Dr. Wetmore of this and or other species of *Ataenius* beetles eaten by the killdeer, the ani, the owl, the mockingbird and the vireo. Mrs. Raquel Dexter found these beetles eaten by the imported toad, and they have also been found in the stomach of the crested lizard, *Anolis cristatellus*. The animal Parasitologist at the Mayagüez Station, Dr. H. L. Van Volkenberg, found this beetle to be the host of a tapeworm cysticercoid, as was reported more at length by Mr. M. F. Jones & J. E. Alicate in the "Development and Morphology of the Cestode, *Hymenolepis cantaniana*, in Coleopterous and Avian Hosts" (Jour. Washington Academy of Sciences, **25** (5): 237–247. Washington, D. C., May 15, 1935). Dr. Gundlach lists this and the Cuban *rhyticephalus* Chevrolat, as species of *Auperia*, from Puerto Rico.

Dr. E. A. Chapin in "A Revision of the West Indian Beetles of the Scarabaeid Subfamily Aphodiinae" (Proc. U. S. National Museum, **89** (3092): 1–41. Washington, D. C., May 23, 1940) describes **Ataenius beattyi**, 3.5 to 4.0 mm. long, as "sooty black, anterior margins of head and prothorax and legs castaneous," from the Virgin Islands and Barbados. Prof. J. A. Ramos (1947–41) found it on Mona Island.

Dr. E. A. Chapin having examined 1,714 specimens, describes his **Ataenius luteomargo** (1940–36) as "piceous, margins of head and pronotum indefinitely paler, outer two intervals and apices of elytra yellowish to brownish yellow" from Dominica and others of the Lesser Antilles, and present in Puerto Rico, Hispaniola and Jamaica. Previous mis-identifications as *Ataenius terminalis* Chevrolat, which occurs only in Cuba and Jamaica, presumably refer to *luteomargo* in Puerto Rico and the Lesser Antilles.

Under the name **Ataenius gracilis** Melsheimer, Dr. Wetmore records the consumption of Aphodiinid beetles by the green heron and the tody. This slender black species has since been collected from all parts of Puerto Rico as well as from Vieques, having first been listed by Drs. Stahl and Gundlach as *Psammodius gracilis* Jacq. Duval, the latter noting "viene por las noches a las velas de las casas."

The other species of **Ataenius** at present listed as found in Puerto Rico are:

edwardsi Chapin, from Puerto Rico and St. Croix,
frater Arrow, from Puerto Rico and the Virgin Islands,
haroldi Steinheil,
imbricatus Melsheimer, from Puerto Rico and St. Croix,
liogaster Bates ?,

miamii Cartwright, from Mona Island (Ramos 1947–41),
strigicauda Bates, from Puerto Rico and Virgin Islands,
tenebrosus Arrow, from Puerto Rico and Vieques,
versicolor Schmidt, and
vincentiae Arrow.

Psammodius bidens Horn is rare, only one recent collection having been made on the beach at Humacao by Dr. R. E. Blackwelder.

The dull, dirty, yellowish-brown **Trox suberosa** Fabricius is a scant half inch long, a tropicosmopolitan species, noted by Drs. Stahl and Gundlach under the name of *Trox crenatus* Olivier. Mr. C. T. Murphy, of Guánica Centrale, was presumably in error in thinking that it was responsible for damage to sugar-cane that he noted, as it is normally a scavenger, and has been found at Río Piedras under a dead rat. Despite its filthy habits, it is eaten by the none too particular *Bufo marinus*, which it almost exactly matches in color and texture of integument. Possibly most of the beetles collected have been picked up under light. Prof. J. A. Ramos found one on Mona Island, at light.

The introduction of the giant Surinam toad. *Bufo marinus* (L.), has made a greater change in the bulk and composition by bulk of the insect population of Puerto Rico than any other single factor since the clearing of the native forest from the more level portions of the Island in the immediately post-Colombian period. In the cane fields which ever increasingly came to occupy the greater part of the more fertile vegas of Puerto Rico, especially and with increasing rapidity after the occupation by troops of the U. S. Army in the Spanish-American war, a population of native species of white grubs feeding on the roots of sugar-cane and other crops was gradually built up, and finally reached such a peak of abundance as to become the decisive factor in determining whether the growth of sugar-cane or any other crop was possible. In the irrigated land of the south coast which the development of reservoirs in the mountains and the sinking of wells made otherwise suitable for cane growing, white grubs became most abundant, but they were present in destructive abundance everywhere on the Island that agriculture was practised. *White grubs were the major insect pest of every crop grown.* It was to discover some means for the control of white grubs that the Sugar Producers' Association started the Experiment Station at Río Piedras. Numerous other small insects, such as common springtails, aphids or ants might possibly have been numerically more abundant, but certainly in bulk, the white grubs of Puerto Rico greatly overbalanced all the other insects of the Island, not only individually, but all other insects combined. Nowhere else in the world did such an ideal environment await the introduction of *Bufo*, which in its native Guiana must be content to feed on ants and miscellaneous insects.

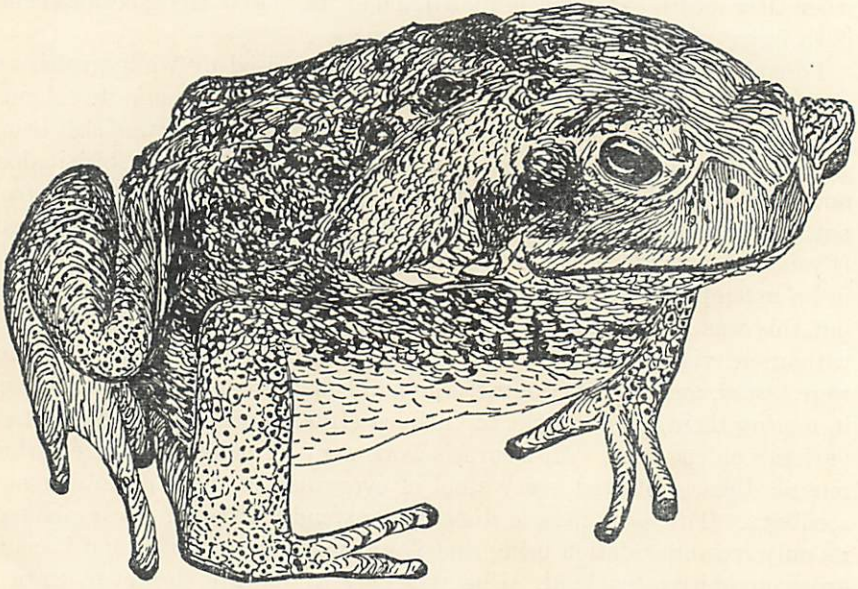
The only parallel is the enormous abundance, reported by R. S. Tohler and A. G. Cooling of individuals of the same "Toads in the Marianas" (Science, **101** (2635): 678. Lancaster, June 29, 1945) following introduction from Hawaii, via Guam, undoubtedly due to a comparable temporarily enormous food supply.

The habits of the May beetles, which are the adults of white grubs, dovetail perfectly with the food requirements of *Bufo*, for they are comparatively slow-moving, terrestrial for two periods each night: when they emerge from the ground to fly to the branches of trees for feeding, and again when they return to burrow in the ground at the base of trees, besides being both large and abundant.

Possibly the greatest damage to sugar-cane caused by white grubs was in the years just before World War I, at Guánica Centrale and its colonos, where Otaheite or White Transparent (Caña Blanca) cane was still being grown. This old variety does wonderfully well in new land, but it does not have a strong root system, and when white grubs completely destroy both rootlets and root-stock, it rots quickly, even before it can be harvested. It was customary for the mill to begin grinding by the middle of December, in an attempt to rescue something from the fields most heavily infested, but this was no solution of the problem. In an attempt to use varieties with more vigorous root systems, those recently developed in Barbados were tested, and Mr. H. Bourne, who had helped the Hon. John R. Bovell in rearing them, was brought to Guánica (Hda. Santa Rita) to breed new varieties on the spot. All Bourne's work went for naught, however, when mosaic disease infected every stool of every one of these promising new seedlings. To escape mosaic disease, the spindly Uba cane was planted, its only recommendation being that it was immune to mosaic and it could grow on unirrigated land. Uba was only a stop-gap, however, until a really superior cane could be found, but the introduction and spread of BH(10)12 a few years later was possible only because the white grub problem was solved (unfortunately, only temporarily, as we now know) by that time.

Mr. D. W. May, Director of the Agricultural Experiment Station at Mayagüez, obtained a few toads from Barbados in 1920, and Mr. R. Menéndez Ramos, Director of the Insular Experiment Station at Río Piedras, brought some in person from Jamaica in the winter of 1923–24. From these two introductions have descended all the toads that had eliminated white grubs from cane fields by a few years later. The shallow lagoons near Guánica, and the smaller irrigation reservoirs and ditches along the remainder of the south coast provided a suitable environment for the development of the immature stages of *Bufo marinus*, and the enormous number of May beetles for months each spring and fall was an apparently

inexhaustible supply of suitable food for the adults, until it was gone. Some of the men at Aguirre claimed that the use of subsoiling Fowler gyrotiller killed the grubs in the soil that it plowed up, but its extensive use merely happened to coincide with the enormous increase in toad population which was the real cause of the disappearance of the white grubs. By 1932, when the Fourth Congress of the International Society of Sugar-Cane Technologists was held in Puerto Rico, the results of the presence of the toad were too obvious to be ignored. · "The Food Habits of the Introduced Toad, *Bufo marinus*, in the Sugar-Cane Sections of Porto



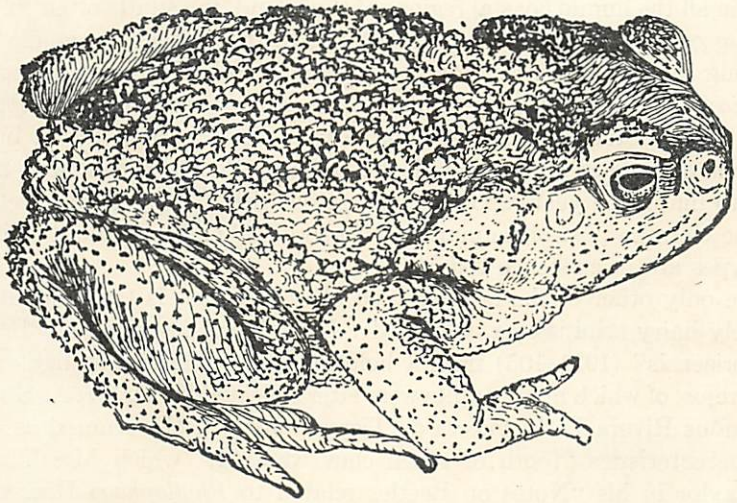
Female of the introduced Giant Surinam Toad, *Bufo marinus* (L.), less than natural size. (Drawn by G. N. Wolcott.)

Rico" (Bulletin No. 74, San Juan, March 1932) which had been investigated by Mrs. Raquel Dexter, detailed both the beneficial and the injurious aspects, the former so greatly preponderating that the entomological delegate from Hawaii, Mr. C. E. Pemberton, promptly made a shipment of them to Hawaii, and took more with him in person.

No such apparently inexhaustible food supply awaited *Bufo* in Hawaii as it had found in Puerto Rico, but otherwise the environment was suitable, and the benefits of its introduction in practically eliminating many kinds of insect pests were so apparent that introductions were made from there to Queensland, Australia, and to many of the smaller islands of the Pacific.

The story of the giant Surinam toad is incomplete without mention of the

experiences of Mr. Walter F. Jepson, whose "Report on the Search for Parasites of *Phytalus smithi* Arr., Field Investigations on Parasites of White Grubs in the United States and Puerto Rico, and their Shipment to Mauritius" (pp. 66, Port-Louis, Mauritius, 1936) gives an exceptionally good picture of the white grub situation in Puerto Rico at the time he was here. He struggled manfully to carry out his instructions to ship insect parasites of white grubs to Mauritius, but it was so obvious that effective control was primarily due to the toads, and not to insects, that in addition he took with him sixty live toads. The authorities in Mauritius, totally



Male of the introduced Giant Surinam Toad, *Bufo marinus* (L.), less than natural size. (Drawn by G. N. Wolcott.)

unprepared for such an importation, ordered the toads destroyed and years later, when finally convinced, had fresh shipments made from Puerto Rico.

Following the peak of abundance of *Bufo marinus* in Puerto Rico, when every possible source of food was devoured, and the toads spread into the less suitable environments of all but the highest mountains, the result was to reduce the common white grub population to a minimum, and apparently to exterminate at least one of the less common species. The investigations of Mr. E. Greywood Smyth on "The White-Grubs Injuring Sugar Cane in Porto Rico" (Jour. Dept. Agr. P. R. 1 (2 & 3): 47–92 & 141–169, illus. San Juan, 1917), confined to the coastal regions, indicated only four endemic species in Puerto Rico, of which the medium-sized one which he named and described as **Phyllophaga guanicana** occurred only in the Guánica region. His type material proves the former existence of this insect, but not a single individual has been collected since, altho Dr. Stuart T. Dan-

forth, the College of Agriculture at Mayagüez, always urged his students from the Yauco and Guánica regions to look for it, when they entered his classes in entomology.

Nor is this the **Lachnosterna monana** of Herr J. Moser (Stettiner Ent. Zeitung, **82**: 181. Stettin, 1921), a similar medium-sized species from the similar xerophytic environment of Mona Island, where toads do not occur, and these May beetles are correspondingly numerous even to the present time.

Somewhat larger than Smyth's *guanicana* is his **Phyllophaga citri,** abundant in all the humid coastal regions of the Island, the adults often collected feeding on the leaves of citrus trees, and, to that extent, economic pests. Judging by size alone, this may be presumed to be Moser's *Lachnosterna insulicola* ("Neue Arten der Gattunger *Lachnosterna* Hope und *Phytalus* Er. (Col.)," Stettiner Ent. Zeitung, **79:** 19–76. Stettin, 1918), but the letter and package containing all the common Puerto Rican May beetles sent to him some years ago for comparison with his types, were returned by the German post-office marked "Gestorben," and it is doubtful if even his types are in existence today.

The only other of the less common coastal species is the large and extremely hairy **crinitissima,** which Mr. J. D. More described in "Insectae Portoricensis" (1924–105) from a holotype male collected at light at Pt. Cangrejos, of which many adults were later collected by Dr. W. A. Hoffman in Muñoz Rivera Park, Puerta de Tierra. Johnny More noted as one of its characteristics "tooth of tarsal claw wanting," which Mr. Lawrence W. Saylor in his "Notes on Beetles related to *Phyllophaga* Harris, with the Descriptions of New Genera and Subgenera" (Proc. U. S. National Museum, **92** (3145): 157–161, pl. 1. Washington, D. C., 1942) used as the basis for making the new monobasic subgenus: **Abcrana.**

Intensive collecting in the higher mountains of Puerto Rico has indicated, to date, the presence at these altitudes of at least four additional species of May beetles. Presumably these mountainous species are as abundant now as when Smyth made his intensive studies of the coastal species, for the introduced toad finds these elevations too cold for its comfort, but the beetles are definitely not common. Dr. E. A. Chapin (1935–70) described **Phyllophaga yunqueana** from a holotype male collected by Dr. Leonard Stejneger in 1900, and **Phyllophaga discalis** from a holotype male intercepted by Mr. R. G. Oakley at Indiera, in the mountains above Yauco, and others in the mountains between Mayagüez and Añasco, collected by J. A. Zalduondo when he was in college.

Mr. Lawrence W. Saylor, describing "Ten New West Indian Scarab Beetles of the Genus *Phyllophaga*, with two new Names" (Washington Academy of Sciences, **30** (7): 305–314. Washington, D. C., July 15, 1940),

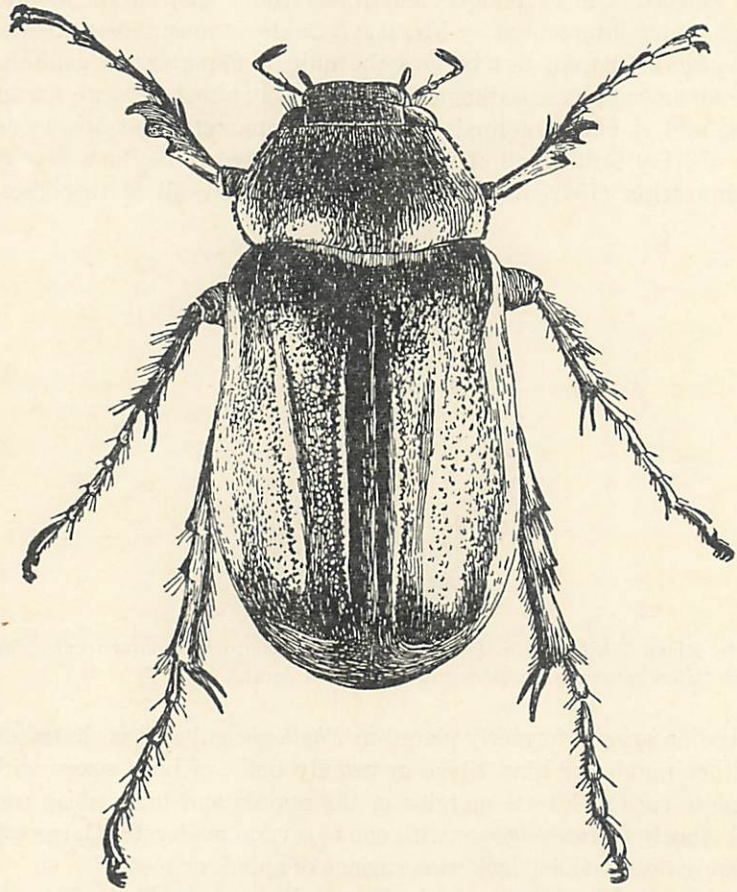
includes two from Puerto Rico: **Phyllophaga (Phyllophaga) adjuntas,** which "externally resembles *P. citri* Smyth, but differs from that species in the nonpruinose dorsal surface, the much longer male antennal club, and the quite different male sixth abdominal segment," and **Phyllophaga (Phyllophaga) wolcotti** from El Yunque, and others from Indiera in the mountains north of Yauco intercepted by Mr. R. G. Oakley, "most closely related to *P. yunqueana* Chapin, but besides the quite different male genitalia, it may be separated by the darker color, less densely punctate head, nontumid clypeus, and shorter antennal club." This completes the non-economic species of May beetles, all of which are now listed in Saylor's new genus of **Cnemarachis** (1942–159) which "includes nearly all of the described

Puerto Rican White Grub, *Phyllophaga* (or *Cnemarachis*) *portoricensis* Smyth, less than twice natural size. (Drawn by G. N. Wolcott.)

West Indian species formerly placed in *Phyllophaga,*" and is characterized by "either middle or hind tibiae or usually both, of both sexes, with an incomplete carina; lateral margins of the middle and hind tibiae usually with obviously serrate edges or with one to several moderately large spines; only rarely do the tibiae lack such carinae or spines or teeth."

The most serious insect pest in Puerto Rico, an endemic May beetle which Mr. E. G. Smyth eventually named **Phyllophaga vandinei** (after Mr. D. L. Van Dine, Entomologist of the Sugar Producers' Station), the type specimens being from Hda. Santa Rita, Guánica, has its distribution limited to the western end of the Island, "its farthest east recorded occurrence being at Manatí on the north coast and Peñuelas on the south." Its eastern analogue, the almost indistinguishable **Phyllophaga portoricensis,** occurs in the remainder of coastal Puerto Rico, and in Vieques. These are big beetles, **Cnemarachis vandinei** adults being 17.0 to 22.0 mm. long, and **Cnemarachis portoricensis** averaging 1.0 to 2.0 mm. larger.

(Judging by the size given by Herr Moser, his *Lachnosterna portoricensis* (1918–62) (= *Phyllophaga borinquensis* Blackwelder), length 21.0 mm., may be either one, as the type locality is merely "Portorico"). The morphological differences noted by Smyth are that in the male genitalia of



The Puerto Rican May Beetle or "Caculo," *Phyllophaga* (or *Cnemarachis*) *portoricensis* Smyth, about three times natural size. (Drawn by G. N. Wolcott.)

vandinei "armatures of theca (are) bicuspidate; spicula sharply deflexed," while in his *portoricensis* the "armatures (are) spatulate at tip; spicula roundly deflexed," but for practical purposes, one identifies them by their geographic distribution. Since this cuts squarely across any natural division of the Island by rainfall or soils, it appears essentially irrational. Economically they are a single species. The adults of both feed indiscriminately on the leaves of sugar-cane, and of many trees. After the first

instar, the grubs eat only live roots of plants. Destruction of the weeds in a field by cultivation forced them to feed on the roots of sugar-cane or of some other crop, and often they were so abundant as to kill the plants the roots of which they attack. Growth of the grubs is rapid, and they may attain full size inside of five months. The entire life-cycle requires but one year, as compared with two years for May beetles of southern United States, three years for many of those of the northern United States, and four years for most of those of Canada. Adults appear in greatest numbers at the time of, or before the spring rains of April, and in somewhat lesser numbers again in late August, with now and then one coming to light at any time from September to March.

Certain especially favored banana plants may be entirely stripped of their leaves by the feeding of one or the other of these species of May beetles, when they are most numerous, but on other trees, the effects of their feeding are not so noticeable. The leaves of introduced trees, like the Australian beefwood (*Casuarina equisetifolia*) and the silver oak (*Grevillea robusta*), often appear to be preferred to what, thru long establishment here, are considered native trees, or those which are really endemic. One may wonder whether the introduction of these foreign trees, plus the extensive growing of sugar-cane, which furnishes preferred food for both adults and grubs, was the lever or factor which so greatly favored these endemic beetles that they could become so abundant, before *Bufo marinus* was introduced, to readjust the balance.

By comparison with what one finds in grub-infested fields in the United States being plowed, those of Puerto Rico would appear to have none of the Scoliid cocoons of the numerous species of *Tiphia* and *Elis* or *Campsomeris*, representing possibly the major factor in the natural control of white grubs in the States. To be sure, representative species of all these Scoliids do occur in Puerto Rico, and a few, attacking other than the economic species of white grubs, are quite abundant, but they are heavily parasitized by numerous Bombyliid flies, thus the influence of the Scoliids attacking the economic species of May beetles is negligible. In all the millions of hand-picked grubs collected at Guánica while Smyth was working on the white grub problem there, not one was noted that was parasitized, nor was a cocoon ever found in the fields being plowed, even when special search was made for them after the releases of Illinois species of *Tiphia* and *Campsomeris*. Very definitely, something must have happened, of which we have no knowledge, since Dr. Gundlach reported *Tiphia argentipes* Cresson as abundant, for no entomologist has ever found it abundant since.

In studying "Porto Rican Cane-Grubs and their Natural Enemies" (Jour. Dept. Agr. P. R., 9 (4): 291–356, fig. 21, ref. 15. San Juan, October 1925), Mr. Harold E. Box was "able to demonstrate that the third instar

grubs are host of the Scoliid wasp, *Dielis* (*Campsomeris*) *trifasciata* F., and are also liable to attack by *D. dorsata* F. and *D. pyrura* Roh. The second instar grubs have been found to serve as host for another Scoliid, *Elis xanthonotus* Roh., and it is not improbable that *Lachnosterna portoricensis* is the host of *Elis ephippum* F." These last two are now considered synonymous, but Mr. Walter F. Jepson, rearing them at Cidra, found that the females also attack third instar grubs. He was able to confirm most of Mr. Box' records, and also noted that second instar grubs, in his mountain laboratory, were attacked by *Elis haemorrhoidalis* F. His rearings were made in the mountains, at Cidra, while those of Box were made at Aguirre on the south coast, two entirely different environments, altho only a few miles apart on the map. It is doubtful, however, if the attack of the very common *Campsomeris dorsata* F. and *Elis haemorrhoidalis* F. on the economic species of *Lachnosterna* is normal in the field, which leaves the much less abundant *Elis ephippum* F. (= *Elis xanthonotus* Rohwer), *Campsomeris trifasciata* F. and the rare *Campsomeris tricincta* F. (= *Dielis pyrura* Rohwer) as their only specific parasites. An abundance of hosts normally implies an abundance of parasites, but despite an enormous abundance of hosts, these Scoliid parasites have always been comparatively rare.

That white grubs never generally became as serious a pest in the more humid parts of the Island as they were on the xerophytic south coast is presumably due, in part at least, to specific parasites which were confined to the humid regions. One of these is an endemic Tachinid fly, *Cryptomeigenia aurifacies* described by Mr. W. R. Walton (Proc. Ent. Soc. Washington, **14** (4) : 198–200, illus. Washington, D. C., January 10, 1912) from Añasco, and generally present in the more humid areas in Puerto Rico. The adults attack May beetles when they raise their wings in flight, and oviposit in the soft upper side of the abdomen thus exposed. The grubs develop rapidly within the body of the beetle, and, to quote Smyth, "the number of pupae found within one dead adult host varies from two to nine, usually four to six. Infested beetles that have died are always found in their burrows in the ground."

A much less common species, with similar habits, is *Eutrixoides jonesii* Walton. Repeated attempts were made to bring puparia of these flies from Guánica's old Central Pagán property at Añasco to their Hda. Santa Rita, but the flies could not survive such an abrupt change in environment.

Of possibly even greater importance in the natural control of white grubs in the more humid and elevated parts of Puerto Rico is the endemic "cucubano," an eyed Elaterid beetle, *Pyrophorus luminosus* Illiger, the luminous subterranean larvae of which feed on white grubs. A single

larva, reared in the laboratory from egg to pupa, ate 68 white grubs, and would have killed more had they been available. The habits of the charming and innocent fruit-eating adults are in most striking contrast to the unbridled ferocity of their voracious larvae, which, after they have temporarily satisfied their appetite for food, appear to kill additional white grubs merely for the sport of killing. The number of luminous cucubanos which one might see after twilight in a dewy meadow was a very obvious visual demonstration of the number of white grubs that they must have destroyed.

Altho one would never guess from the title of Dr. Alexander Wetmore's "Birds of Porto Rico" (Bulletin No. 15, Board Comm. Agr. P. R., *and* Professional Paper, Bulletin No. 326, U. S. Dept. Agr., pp. 140, pl. 10. Washington, D. C., March 24, 1916) that it was primarily a study of the economic food habits of the native and migratory birds, with especial emphasis on white grubs or May beetles, it is in fact just one facet of the attempt to control these pests by natural means. From the standpoint of the cane growers, its conclusions were rather disappointing, for they already knew from personal observation that the boat-tailed grackle or "mozambique" (*Holoquiscalus niger brachypterus*) fed on white grubs, fearlessly following the bull-teams plowing, and picking up the grubs in the furrows just as soon as they were uncovered by the plow. Even today they follow the snorting tractors, the gyrotillers and the Fowler drag-plows, but until recently found little to reward their courage. That the bare-legged owl feeds upon May beetles or "caculos" means little to cane fields in the vegas, for the owls live mostly in the forested mountains, and possibly if someone had examined their stomach contents obtained by Dr. Wetmore and extracted the male beetle genitalia, these rarer mountainous species of *Lachnosterna* could have been described first. The little blue heron also feeds on caculos, and possibly in the more retired fields of "poyal" lands might be a minor factor in control. This completes the list of local birds having any appreciable effect on the May beetles of Puerto Rico, and Dr. Wetmore hesitated to recommend the introduction of any bird from abroad that might feed on them if it became established here.

The later study by Dr. Stuart T. Danforth of the "Birds of Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1926) showed that the least grebe and the killdeer ate beetles, and that grubs were eaten by the local thrush. Dr. Wetmore had emphasized that the cane field environment is most unfavorable for bird life, and the observations of Dr. Danforth offered little additional encouragement, even if they did enlarge the list of birds which, in their own favored environment, might slightly affect the white grub problem.

The investigation by the writer on "The Food of Porto Rican Lizards"

(Jour. Dept. Agr. P. R., 7 (4): 5–37, ref. 8. San Juan, August 1924) indicated that "the common large brown or black tree lizard, *Anolis cristatellus*, is large enough to eat such large, apparently unpalatable and hard to digest beetles as even the May beetles or "caculos." The iguana, *Ameiva exsul*, is amply large enough to eat such beetles, and does in fact eat the white grubs. The iguana is, (however,) exclusively diurnal and the large tree lizard is so largely so that neither of them has any real opportunity to catch May beetles, which are just as exclusively nocturnal."

The iguana is subterranean during most of its existence, usually appearing above ground for only a few hours in the hottest part of the day. It burrows rapidly and easily thru the ground, and eats not only the larval stages but also the eggs of May beetles. Its most serious enemy appears to be the mongoose, *Herpestes birmanicus*, introduced into Puerto Rico first in 1877 and repeatedly in later years. Dr. J. G. Myers in "A Preliminary Report on an Investigation into the Biological Control of West Indian Insect Pests" (Empire Marketing Board 42, pp. 172. London, July 1931) notes that "wherever the mongoose has become established, it tends to extirpate these lizards everywhere, save in the immediate vicinity of towns. This both Dr. Thomas Barbour, recording "Some Faunistic Changes in the Lesser Antilles" (Proc. New England Zoological Club, 11: 73–85. Cambridge, January 10, 1930), and myself have observed in a number of the islands." No other explanation of the enormous increase in the number of May beetles in Puerto Rico by the beginning of the twentieth century seems more logical than that it resulted from the wide-spread destruction by the mongoose of what formerly had been its most important natural enemy, the ground-lizard or "iguana," *Ameiva exsul* (Cope).

The prospect for control by native wild vertebrates being so discouraging, the possibility of using hogs for eating white grubs was explored. For years, Guánica Centrale had herds of hogs to compete with the grackles in picking up grubs after the plows, but when no plowing was being done, the pigs had to be fed purchased corn, which was an annoyance to cane growers, and decidedly uneconomical. Women and boys could be hired more cheaply, and millions of grubs and beetles were collected by hand each year for many years, concerning which one may consult the account by Mr. E. H. Barrow giving definite figures (Jour. Dept. Agr. P. R., 8 (2): 22–26. San Juan, April 1924), in every Hacienda on the south coast. Dynamite exploded in a grub-infested field from which the cane has just been cut makes an impressive crater, and sends earth and grubs high in the air, but when they come back to earth, the grubs seem uninjured, and unless promptly captured, soon burrow in among the clods and disappear from sight. This is only the most spectacular of the valueless attempted methods of artificial control, as recounted by Dr. Richard T. Cotton on

"Experimental Work on the Control of White Grubs in Puerto Rico" (Jour. Dept. Agr. P. R., **2** (1): 1–18. San Juan, January 1918). In later years, the use of carbon bisulfide emulsion and of ortho- and paradichlorobenzene was found successful in killing grubs, without injury to the cane plants, but the expense of the chemicals plus that of application made the cost prohibitive, and none of these methods of chemical control has ever been used on a field scale.

Within a few years after *Bufo marinus* became at all abundant, all means of chemical control became obsolete, and practical growers filled gunny sacks full of toads from localities such as lagoons, reservoirs and pools where they could be easily collected in large numbers, and released them in grub-infested cane fields, where they would be of most immediate practical benefit. A few years later, distribution of *Bufo marinus* thru its own efforts had become so uniform and universal that cane growers calmly accepted its beneficial presence as part of the normal processes of nature, tending to forget, after the disappearance of the white grub menace, how serious a threat it had once been to the agriculture of the Island.

The solution of the white grub problem by the introduction of the toad was indeed a major triumph for biological control, at least during the years when it was most effective. Its fundamental weakness was in its very effectiveness however, for despite the supposed omnivorous food habits of the toad, the major elements in Puerto Rico are May beetles and other Scarabaeids, "vaquita" leaf beetles and millipedes. When these are gone, and we have close to total control of white grubs in cane fields, there is little else for the toads to eat. Vast numbers of them must have perished of starvation. As was explained in detail in "What has happened to the giant Surinam Toad, *Bufo marinus* L., in Puerto Rico" (Revista de Agricultura y Comercio de P. R., **38** (1): 25–29, fig. 7. San Juan, January–April 1947), "scarcity of food is only one factor which increasingly tends to limit the abundance of the Surinam toad. In the West Indies at least, the weakest point in its life-history is the tadpole or pollywog stage, which must be passed in fresh water. In addition to all the large and fierce dragon fly nymphs which attack the helpless tadpoles, the even larger and more voracious larvae of the endemic Dytiscid beetle, *Megadytes gigantea* Castelnau, appear to be the deciding factor in whether any tadpoles will survive to become adults. A single one of these large beetles may lay dozens of eggs in a pool, from which emerge small worm-like larvae with enormous jaws. At first they feed on insects and very small animals, but before they are more than half-grown, they attack tadpoles almost ready to leave the water, and often are forced to complete their growth by cannibalistically feeding on each other when every tadpole in the pool has been destroyed."

Reproduction also became more difficult because after three exceptionally

dry years, Cartagena and Guánica Lagoons completely dried up, and thus disappeared the most favorable environments for the development of the tadpoles on the south coast. Rapidly the balance for the toad began to swing in the opposite direction. Cane growers of a new generation, inexperienced in the plagues of white grubs that had infested the fields of their fathers, again began to complain about the abundance of white grubs. When advised to bring toads to infested fields, the problem was where to find the toads.

The rapid increase in abundance in recent years of the common bullfrog of the southeastern United States, *Rana catesbeiana* Shaw, introduced in 1935 into Puerto Rico, at the same time that the toad was becoming so scarce, was thought to indicate a possible incompatibility between the two introduced amphibians. Their pollywogs inhabit the same pools, altho the adults occupy entirely different ecological niches. In a study of the food habits of the frog, Mr. Mario Pérez found that altho the frog may be cannibalistic in devouring its own smaller adults and larvae, it did not eat either the pollywogs or the small adults of *Bufo marinus*. The tadpoles of both feed primarily on aquatic algae, of which an amount ample to feed them rapidly grows on the stones and vegetation of every pool. There is thus no serious competition between frog and toad, either as larva or adult, for the frog adult feeds extensively on aquatic insects and other items, and but rarely on the Maybeetles that are the mainstay of the toad.

"The Rise and Fall of the White Grub in Puerto Rico" (American Naturalist, **84** (816): 181–191, ref. 19. Lancaster, Penn., May–June 1950) shows how essentially temporary was this all too effective control by a single natural factor, and re-emphasized the importance of finding a chemical means of attaining the same end which would be entirely under the control of the grower. It has been found that both aldrin (Hyman 118) and the gamma isomer of benzene hexachloride (BHC) are very toxic to even the largest grubs, as little as 2 pounds per acre of either chemical giving commercial control. In the year and a half that these chemicals have been tested, no appreciable diminution in effectiveness is noticeable, and it is possible that they will render soils to which they have been applied permanently sterile to white grubs.

Much smaller than any of the May beetles just noted, only 8.0 or 9.0 mm. long, is what Smyth described as *Phytalus insularis*, but was later identified as **Phytalus** *apicalis* Blanchard, and is now listed under Saylor's new generic name of **Clemora.** This little beetle occurs not only everywhere in coastal Puerto Rico from Faro de Cabo Rojo to Luquillo, but even in the mountains, at Aibonito, and also on St. Thomas. At Guánica, Mr. E. G. Smyth collected large numbers feeding on *Amaranthus* and Pará grass, and at Garrochales on *Lantana involucrata*, but at Pt. Cangrejos it at times almost defoliates Snow-on-the-Mountain (*Phyllanthus nivosus roseopictus*).

In a sandy field being plowed near the bridge between Palo Seco and Pt. Salinas, numerous skulls of third instar grubs on this beetle were found entangled in the outer threads of Scoliid cocoons from which adults of *Elis haemorrhoidalis* F. usually emerged, altho from some cocoons, the hyperparasite, *Anthrax gorgon* F., came out. This was the first discovery anywhere in Puerto Rico of fresh Scoliid cocoons associated with empty white grub skulls that could be identified. Subsequently, however, Mr. Harold E. Box (1925–334), finding females of this wasp very abundant in restricted localities, collected and transported them to other places where unparasitized grubs were numerous in Aguirre's cane fields. The grubs are so small that they must occur in large numbers to cause any serious damage, and are hardly of economic importance, but it was an interesting experiment, and most successful, for parasitism increased rapidly where the females had been released.

Cane growers in the British West Indies are accustomed to differentiate between the two kinds of May beetles as "brown hard-backs" for the *Lachnosterna*, and "black hard-backs" for those generally black instead of brown. The shiniest and most nearly impunctate of the black hard-backs in what Drs. Stahl and Gundlach listed under the genus *Chalepus*, and, after various changes to *Dyscinetus* and *Parachalepus*, is now called **Chalepides barbata** F. Presumably it was named *barbata*, not after Barbados, where it does not occur, but from the beard of long grey hairs at the rear end of the body projecting from under the elytra. Before the introduction of *Bufo marinus* into Puerto Rico, it was very abundant, especially in the more humid regions, and adults attracted to lights at night might often be a terrific nuisance. At a dance in the open-air pavilion of the Bayamón Saddle & Motor Club, they accumulated in such numbers on the dance floor as to stop the dance, for no sooner was the floor swept clean than additional beetles flew in to impede the progress of the dancers. The beetles are essentially harmless, and their grubs feed only on decaying vegetation in the soil, never, even accidentally, eating live roots. The first flights of adults to light in the spring usually came in mid-April, and by early in May they constituted the vast majority of all the insects coming to light. They proved to be as welcome to *Bufo marinus* for food as were the brown hard-backs, and toad excrement pellets have been noted which contained the remains of as many as 17 of these beetles. Naturally, they became scarce when the introduced toad became most abundant, and even with the present decreased numbers of toads, made but a single one-night appearance at Río Piedras in 1947, most of which was absorbed by the toads, reappearing as excrement pellets by the next morning.

On the night of September 23, 1948, when a hurricane was passing over Matanzas, Cuba, Key West, Florida and the Everglades, but when there was no rain at Río Piedras, and when there had been none in several days,

many of these beetles emerged from the ground, and were swept up from the hallways of the Experiment Station building next morning, or appeared in pellets of toad excrement. No other instance of response to barometric pressure is on record, and this may have been merely a coincidence.

Dyscinetus picipes, originally described as a *Chalepus* by Hermann C. C. Burmeister in his "Handbuch der Entomologie" (**5:** 79. Berlin, 1847) from material from Puerto Rico, is similar in general appearance to *barbata*, but is not bearded, and the elytra are distinctly striate and punctate. Not especially common, the adults have been noted feeding on the roots of sugar-cane at Carolina, of malojillo at Mayagüez, and on the corms and roots of yautia at Cayey, and would possibly be a major pest were they more numerous.

Dyscinetus morator F., repeatedly recorded from Puerto Rico as *Dyscinetus trachypygus* Burmeister, separately or in synonymy with *picipes* may be nothing more than a name, as all specimens in the collection of the Experiment Station at Río Piedras were identified by Dr. Chapin in 1932 as being *picipes*.

With stronger spines on its legs, with elytra deeply striate and punctate, not larger than the other black hard-backs, but thicker, heavier and more heavily chitinized, and with roughened areas on the abdomen by means of which it audibly makes known its objection to being held between the fingers, is what always up to now has been called *Ligyrus tumulosus* Burmeister. Or almost always, for Chevrolat's determination of Dr. Gundlach's specimens was *Ligyrus fossulatus* Latreille. The only species listed by Dr. Blackwelder (1944–254) from Puerto Rico are **Ligyrus cuniculus** F. and **Ligyrus fossor** Latreille, altho all specimens in the Station collection at Río Piedras were identified in 1932 by Dr. Chapin as **Ligyrus tumulosus** Burmeister, a species which Dr. Blackwelder restricts to continental United States, Mexico and Cuba. At the time that Mr. Eugene Graywood Smyth was commencing his white grub investigations at Hda. Santa Rita, Guánica, the larvae of *Ligyrus* were temporarily very abundant in cane fields, but it was only after extensive rearing that the essentially harmless character of their feeding was decisively proved. They eat only decaying vegetation in sandy soil: typically the dead cane stool which the larger *Lachnosterna* grubs have killed. The *Lachnosterna* grubs feeding on live cane roots have yellow heads, while those of all feeding on decaying vegetation are brown, or at least a much browner yellow. *Ligyrus* grubs also do not have the permanent quirk in their body characteristic of *Lachnosterna*, and when the sandy land in which they live has been saturated by rainfall, have been observed crawling about on its surface, their body dragging out straight behind, until the top soil has dried out sufficiently to

permit life for white grubs beneath its topmost layer. Eventually, Smyth published life-history summaries for all of these grubs, showing that *Ligyrus* can complete its entire life-cycle in less than three months. Harmless as *Ligyrus* may be in its immature stages, however, the adults sometimes bore into the base of live cane stalks, but this injury amounts to only one percent of some 50,000 stalks examined in all parts of the Island in 1921.

Before the advent of the imported toad in Puerto Rico, *Ligyrus* was often very common in most favorable environments, and they still are on Mona Island. This abundance was despite heavy parasitism of the grubs, first noted by Mr. H. Bourne at Hda. Santa Rita, Guánica on June 20, 1913. He wrote as follows:

"While I was getting these grubs, I found 28 cocoons of a wasp, very probably the black one with two reddish bands across the abdomen, *Campsomeris dorsata* F., because while digging, two flew out. This wasp is commonly seen in callejones and cane fields. I also found one grub with a medium sized larva attached to it, and one with the egg of the wasp freshly laid on its body."

Subsequently, Mr. Harold E. Box noted that this wasp "succeeds in periodically reducing the numbers of *Ligyrus* grubs in each locality almost to the zero point."

In the size of the head and in other gross characters, the fully-grown third instar grubs of *Ligyrus* are practically indistinguishable from those of the second instar of the sugar-cane rhinoceros beetle of Puerto Rico and the Virgin Islands. This is now known as **Strategus barbigerus,** described by Dr. E. A. Chapin (Jour. Washington Academy of Sciences, **22** (15): 449–456, fig. 10. Washington, D. C., September 19, 1932), but from the first record by Ledru until recently, it has been recorded under the name of *Strataegus titanus* F. *Strataegus* grubs primarily feed on rotten wood, especially the roots and stumps of trees in the soil, but when these have been consumed in recently cleared land, readily attack old cane stalks and decaying cane seed, and may eventually attack live cane root-stalks and rootlets when other more acceptable sources of organic matter are lacking. When no more new land was being brought under cultivation, reports of their injuries ceased, and the beetles are comparatively rare now as they are just small enough to be swallowed by the largest females of *Bufo marinus.* They are too large for the male toads, but the females form a ring around a beetle, and seem to dare each other swallow the hard, horny, spiny creature. After several attempts by the bravest toads to keep down such a furiously resisting mouthfull of live food, one toad accidentally swallows the beetle so that its struggles force it down into her stomach, and with her hand over her mouth, she keeps it down until all movement ceases. Only on Mona Island is the beetle at all common now, and only on Mona is

its specific Scoliid parasite, *Campsomeris atrata* F., still to be found in any abundance. From a dead beetle on Mona, the fly *Sarcophaga rapax* Walker has been reared, but it is doubtful if this is more than a scavenger.

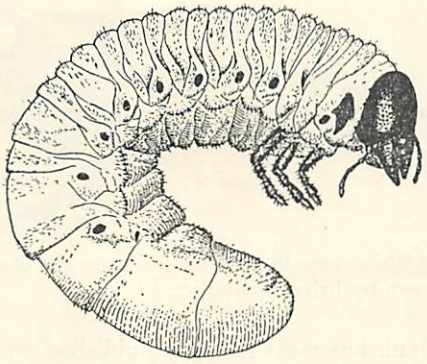
The extremely tough and heavily chitinized prothorax of the males rises in two lateral tubercles and a median anterior horn, always forked at the tip, or at least tending to be forked even when least developed. "By means of these horns the powerful male beetles can tear their way easily into mature sugarcane, and even into the solid wood of the coconut palm. The males use the horns also in fighting, and engage often in long battles. The size of the beetles, as well as of the horns, seems to be determined largely by the amount of food that was available for the larva during its period of feeding," according to Mr. E. G. Smyth, in discussing "The Rhinoceros Beetles" (Jour. Dept. Agr. P. R., **4** (2) : 3–29, illus. San Juan, April 1920). The female beetles have no horns, and indeed their prothorax is only slightly roughened anteriorly. They lay their pearly white, opaque, oblong-oval eggs singly in hardened spherical cells of earth, in which the eggs swell before hatching to be over 5.0 mm. in diameter. The beetles are often infested by mites, supposedly only catching a ride, but Smyth noted that some of these mites leave the female when she oviposits, and attain an enormously distended abdomen feeding on her eggs. The grubs, at least when reared in captivity, seem especially susceptible to the Green Muscardine fungus, *Metarrhizium anisopliae*, and also suffer from hard black spots, supposedly bacterial in origin, which gradually enlarge and may eventually cause death. The life-cycle is completed in a year.

Despite their much greater size, rhinoceros grubs seem as susceptible to the newer insecticides, such as the gamma isomer of benzene hexachloride, chlordan and Hyman 118, as are the considerably smaller ordinary white grubs. With the practical disappearance of the toad in 1948–9 in the more xerophytic parts of the Island, rhinoceros grubs began to appear in cane fields, possibly every thirtieth or fiftieth grub collected at Isabela or Aguirre being a *Strataegus*. When placed in the laboratory tests with the other grubs, and supplied with rotten wood to eat, they died at concentrations of the chemicals no greater than those killing the *Phyllophaga* grubs, but because of insufficient numbers, these data are not as extensive or conclusive as for the smaller grubs. Nevertheless, it may be presumed that few rhinoceros grubs will develop to large size in fields treated with even the minimum amount of insecticide to kill white grubs.

Apparently the toad is a much more important enemy of the rhinoceros beetle than was supposed, for not only did these beetles practically disappear when the toads were numerous, and again appear in numbers when toads were scarce, but they have continued abundant in St. Croix during all these years. St. Croix has no permanent streams or fresh water ponds,

and *Bufo marinus* can with the greatest difficulty maintain itself there, for despite its specific name, its tadpole or pollywog stage can be passed only in fresh water.

Strategus oblongus Palisot de Beauvois is at present considered the correct scientific name by Dr. Blackwelder for the coconut rhinoceros beetle of Puerto Rico, altho in all economic literature it is given as the synonymous **Strataegus quadrifoveatus** Palisot de Beauvois. Drs. Stahl and Gundlach listed it under what the latter thought "acaso nombre manuscrito": *Strataegus laevipennis* Chevrolat. It is one of the largest and certainly the heaviest beetle in Puerto Rico, with shining black, polished elytra, the male often having very well developed horns, of which the median anterior one is never forked. By means of these horns, it is able to burrow into the base of mature coconut palms, but its principal economic

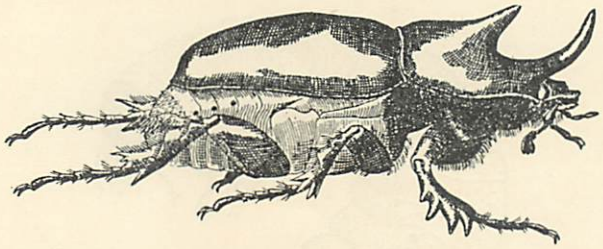


Grub of the Coconut Rhinoceros Beetle, *Strataegus quadrifoveatus* Palisot de Beauvois, natural size. (Drawn by Fritz Maximilien.)

injury is to young palms which have not yet developed a stem. Burrowing into the sand close beside such young palms, it rasps and chews into the base of the fronds, often killing the young seedling. Such injuries become abundant after hurricanes, when many such young palms are being set out in established palm groves to take the place of those which have been destroyed, and at this time also the beetles are most numerous. The eggs are laid in the rotting trunks of dead palms, on the interior of which the grubs feed, quickly causing them to collapse. The attempted use, even very temporarily, of the dead palms, for fenceposts or anything else, is not only impossible, but such dead palms are a menace in the grove, and they must be burned as soon as possible to prevent the adults from developing from the grubs feeding on their interiors. Unfortunately, few growers can be convinced of such necessity, and thus a few years after a destructive hurricane the beetles become injuriously abundant. The cost of hand-

collection of grubs and beetles, when financed by government agencies, may easily run into thousands of dollars, and becomes big business for small boys doing the collecting.

The coconut rhinoceros beetle occurs in all parts of Puerto Rico, in the mountains as well as along the coast, and the adult may attack other kinds of palm besides the coconut, and it sometimes burrows into a stool of sugar cane. The grubs are able to feed on the roots of deciduous trees, and in moist decaying tree stumps, and even in undisturbed piles of cachaza. The most exceptional host record is of a pineapple fruit at Palo Seco being tunneled into by an adult. With a stout thread tied securely around its middle, the adult beetle may serve as an exciting and somewhat dangerous pet for children, for when held suspended, it unweariedly circles like a miniature airplane, until the erosion of its bonds permits escape.



Male of the Coconut Rhinoceros Beetle, *Strataegus quadrifoveatus* Palisot de Beauvois, natural size. (Drawn by Fritz Maximilien.)

Mr. Harold K. Plank has most recently published on the "Life-History, Habits and Control of the Coconut Rhinoceros Beetle in Puerto Rico" (Bulletin No. 45, Federal Experiment Station, Mayagüez, pp. 35, fig. 12, ref. 24, Washington, D. C., November 1948), detailing the results of his investigations since 1935: a most detailed and beautifully illustrated work.

The horns of the male rhinoceros beetle are on its prothorax: those of **Homophileurus quadrituberculatus** Palisot de Beauvois are on its head, with only comparatively low tubercles on its prothorax. Dr. Gundlach first noted "la larva vivió en el nido o bulto de *Termes morio*," and all more recent collections of adults have been made in nigger-head nests of termites, one at Ciales included also "berraco" ants inhabiting part of the nest with the beetles and the termites. These are large and powerful beetles, over an inch long, and half an inch wide, with elytra deeply striate and punctate, previous identification by Dr. E. A. Schwarz as *Phileurus didymus* L. being referred to this species.

The somewhat smaller **Phileurus valgus** L. has been collected at light in Ponce, and in rotten wood at Adjuntas, Lares and Barranquitas.

Epiphileurus puertoricensis, described by Dr. E. A. Chapin (1935–69) from adults in decaying palm at Villalba, has also been found at Barranquitas.

Cyphonidae (Helodidae)

Prionoscirtes dilaticornis Champion, as identified by Mr. H. S. Barber, was intercepted on oranges trees in the mountains back of Ponce, and at Villalba, by Mr. R. G. Oakley. This is a small black beetle, originally described from St. Vincent. Numerous others of these obscure little beetles, collected on a variety of hosts and on flowers at various localities by Mr. Oakley, were identified only to a species of **Scirtes,** which is the determination given by Sir Guy A. K. Marshall to others found in the squares of cotton in a field near the beach at Laguna Tortuguero. No specific injury to the cotton could be observed at the time, and no collection has since been made on this host.

Ptilodactylidae

Ptilodactyla "perhaps **emarginata** Chevrolat" is the determination given by Mr. H. S. Barber to beetles intercepted by Mr. R. G. Oakley in the mountains of southern Puerto Rico.

Heteroceridae

Heterocerus spp., as determined by Mr. H. S. Barber, have been collected in the mud of Guánica Lagoon by Prof. J. A. Ramos.

Byrrhidae

Lioon sp., as doubtfully determined by Mr. H. S. Barber, was intercepted by Mr. R. G. Oakley on betel palm at Adjuntas.

Elmidae

The Elmids live in swiftly running water, where they cling to flat stones or aquatic vegetation. Dr. Stuart T. Danforth, making the first collections of these beetles in Puerto Rico, had **Cylloepus danforthi** named for him by Mr. P. N. Musgrave, describing "Two New Elmidae from Puerto Rico, with Description of New Genus (Coleoptera)" (Proc. Ent. Soc. Washington, **37** (2): 32–35, fig. 1. Washington, D. C., February 1935), characterized as "elongate, subparallel; dull black with dark burnt sienna tinges," the males being 1.6 mm. long and the females 1.8 mm. Later, Don Julio García-Díaz, in conducting his survey of the aquatic insects of Puerto Rico, collected not only this species, and **Neoelmis gracilis** Musgrave, which is "elongate, parallel, opaque, dark reddish-brown, length 1.4 mm.", but also **Phanocerus hubbardi** Schaeffer, originally described from Jamaica;

all three being abundant in the steam at La Mina on El Yunque, and in the Río Yúñez at Florida. **Elmis filiformis** Darlington, as doubtfully identified by Mr. H. S. Barber, was collected by Dr. W. A. Hoffman, possibly at El Semil.

Limnichidae

Eulimnichus sp., as determined by Mr. H. S. Barber, is a small aquatic beetle collected at light at Mayagüez. **Limnichoderus** sp. "near *nauicularis* Casey" was intercepted by Mr. R. G. Oakley at Ponce in water.

Melasidae (Eucnemidae)

Arrhipis lanieri Guérin-Méneville, originally described from Cuba, but listed by Fletiaux from Puerto Rico, is the only previously undescribed representative of this family not included by Mr. W. S. Fisher in his "New Eucnemid Beetles from Puerto Rico" (Jour. Agr. Univ. P. R., **19** (2): 65–66. Río Piedras, October 15, 1935). All four of these were collected by Mr. R. G. Oakley, a keen "intercepter" of previously unknown beetles, with an unerring ability to find the new and unique.

Dirhagus puertoricensis is characterized by Mr. Fisher as 2.75 mm. long, "nearly black, and in having the antennae pectinate and the elytra ornamented with two transverse, whitish pubescent fasciae," the type having been found on coffee in the mountains above Ponce.

Dirhagus oakleyi is 2.6 mm. long, has bicolored elytra, "with golden yellow pubescent fascia at apical third, the antennae flabellate," the type from pomarrosa (*Eugenia jambos*) at Aibonito.

Adelothyreus insularis is from the same host and type locality, 3.0 to 3.25 mm. long, with the "body narrow, subcylindrical, black, with an elongate, brownish yellow spot covering the exterior three-fourths of each elytron, . . . pubescence sparse, uniform, whitish."

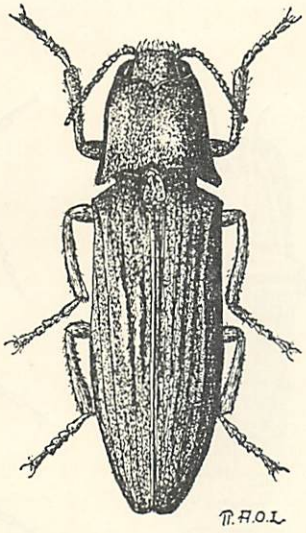
Nematodes puertoricensis is 5.0 mm. long, has a "body very narrow, subcylindrical, dark reddish-brown, . . . the elytra not distinctly striate," and was found on weeds at Matrullas Dam, near Orocovis.

Elateridae: Click Beetles

Adelocera rubida, described by Otto Schwarz ("Neue Elateriden," Stettin. Ent. Zeit., **63:** 195. Stettin, 1902) from specimens collected on Mona Island, has not been found since, so far as known.

The larvae of most Elaterid beetles are phytophagous, but those of one species endemic to Puerto Rico have long been known to be predaceous. In "The Accidental Introduction of a Beneficial Insect into Puerto Rico" (Caribbean Forester, **3** (2): 58–9, pl. 1. Río Piedras, January 1942), similar larval habits of **Chalcolepidius silbermanni** Chevrolat are first

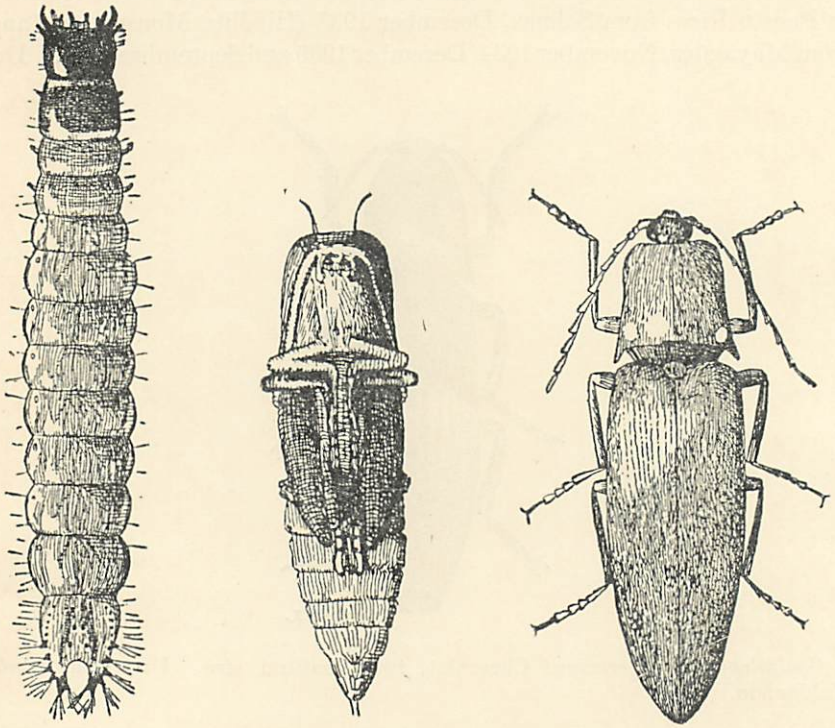
noted. This is possibly the largest and certainly the broadest of any of the click beetles to be found here, dull velvety brown or grey in color, with deeply furrowed elytra. It occurs in Mexico, Central and northern South America, Jamaica and even in St. Vincent, but had not been collected in Puerto Rico previous to 1933. It "is comparatively common in Hispaniola, where one often sees the adults sunning themselves in a sun-lit spot on the bark of a tree in a woodland glade. Some years ago, students of the late Dr. Stuart T. Danforth, at Mayagüez, began bringing in specimens collected in Puerto Rico: from Salinas, December 1933 (Hipólito Monserrate), and from Mayagüez, November 1934, December 1936 and September 1937. Dr.



Chalcolepidius silbermanni Chevrolat, twice natural size. (Drawn by Raúl Maldonado.)

Luis F. Martorell found one specimen in April 1939 at what is now Punta Borinquen Air Base, and subsequently reared one from a log of *Albizia lebeck* at Ponce infested with larvae of *Elaphidion irroratum* L. and *E. spinicorne* Drury." A log of "almácigo" (*Bursera simaruba*) from Camuy, infested with larvae and pupae of *Lagochirus araeniformis* L., was found to also contain several of these large Elaterid larvae. "Hispaniola is to the windward of Puerto Rico, both for the prevailing trade winds and for hurricanes. Unquestionably *Chalcolepidius silbermanni* was brought to Puerto Rico by commerce, for lumber, both as mahogany planks and unbarked railroad ties, has formed an important item of importations from the Dominican Republic to Puerto Rico for many years past. The un-

peeled ties are often heavily infested with Cerambycid larvae, fortunately all species already occurring in Puerto Rico, and in some of these the predaceous Elaterid larvae were also present: the predator accompanying the host insect. This appears to be one of the few instances of the accidental and quite unanticipated introduction of a beneficial insect." At no stage of its existence is any part of the body of *Chalcolepidius silbermanni* luminous.



The Cucubano, *Pyrophorus luminosus* Illiger, larva, pupa and adult, twice natural size. (Drawn by G. N. Wolcott.)

Luminosity is concentrated in two spots on the rear corners of the prothorax of the adults of the endemic "cucubano," **Pyrophorus luminosus,** described by J. C. W. Illiger ("Monogr. d. Elateren (Pyrophorus)," Mag. Gesellschaft Nat., Fr. I: 149. Berlin, 1807), and these luminous spots are sharply defined even in its pupa. The larva, however, is luminous generally in the prothorax, and slightly so on the rear edge of the following segments, but shows this luminosity only when disturbed. The cucubano larva is a subterranean wireworm, which when fully grown is nearly two

inches long, quite plump, and the color of old ivory. It feeds on other subterranean insects, more especially white grubs and "vaquita" larvae because they are normally most abundant, but has been found inside an over-ripe melon, presumably in pursuit of a melonworm, the caterpillar of *Margaronia hyalinata* L., and in a *Diatraea* tunnel at the base of a stalk of sugar-cane. Mr. Francisco Seín, Jr., reared larvae from egg to pupa in captivity, and by actual count found that a single cucubano wireworm ate sixty-eight white grubs in attaining full size, as is related in "El Cucubano, *Pyrophorus luminosus* Illiger" (Circ. No. 80, Estación Experimental Insular, pp. 5–8 fig. 3. Río Piedras, October 1923). This number does not include those killed for sport, as when it had eaten all that it could hold, it would continue to kill additional grubs merely for the joy of killing. Unquestionably the cucubano was an important factor in the control of white grubs in the more humid sections of the Island, but it rarely occurs on the xerophytic south coast where injury by white grubs was greatest.

In an effort to control the Barbadian white grub, *Phytalus smithi* Arrow, some thousands of living cucubano larvae were collected at Cidra and sent by airplane express to Barbados in 1933, and a few years later others were sent to Mauritius, where the same Barbadian white grub is an even more serious pest. Cucubano adults have been noted in the regions where these larvae were released in Barbados, and possibly the species has become established there. On the basis of what it costs to hand-pick white grubs in Barbados, as compared with how many grubs each cucubano larva destroys, it was estimated that these imported cucubano larvae were worth all they cost, even if they had all died in the first generation.

The introduction of the giant Surinam toad, *Bufo marinus* (L.), into Puerto Rico affected the cucubano in two ways: by reducing the number of white grubs available for food for the larval cucubano, and also because the luminous adult cucubano proved to be quite as acceptable to the toad for food as were the caculo adults. At the lower elevations along the north coast, *Pyrophorus luminosus* practically ceased to exist when *Bufo marinus* had reached its peak of abundance, but in the mountains where it was too cold for comfort for the toads, the cucubano remained as abundant as ever. By 1940, a few adult cucubanos might again be seen on the north coast, marking the passing of the crisis caused by the introduction of the toad.

The visiting Botanist Ledru noted the presence of the cucubano in 1780, using the name *Elater phosphoreus*, but the insect had been named before Dr. Gundlach issued his list, and was correctly noted by him. Mr. R. H. Van Zwaluwenburg was the first to record the feeding of the adults on the fruit of decaying fallen mangoes, and of the larvae on white grubs. Under normal conditions, the life-cycle of the cucubano is completed in a year,

the adults appearing in the spring, from April to June, and the first pupa by the following January.

In contrast to the activities beneficial to man of the predaceous larvae of the larger Elaterids in Puerto Rico, the phytophagous larvae of the smaller species are definitely injurious to cultivated crops, especially to young tobacco transplants. In fallow land or pastures, these slender little wireworms feed on the roots of grass or weeds, causing no appreciable injury so far as the farmer is concerned, but when a field is plowed and cleared for planting tobacco, the wireworms are deprived of their normal food for a time, until the young tobacco plants are set out. The wireworms burrow into their roots and underground stems, often killing the plants, which have not yet recovered from the shock of being transplanted. In Cuba the damage is much more severe than in Puerto Rico, altho the species concerned are the same in both islands. Field control has been obtained in Puerto Rico by burying "considerable numbers of small potatoes in the ground where damage is anticipated. The potatoes are preferred by the wireworms to tobacco plants, which thus escape injury. To be completely effective in ridding the field of wireworms, however, it is most desirable to dig up the potatoes after they have been in the tobacco field for a week or two, and destroy them together with the wireworms which they contain. This is easily accomplished if each potato is impaled on a wire which extends above the surface of the ground, and to the other end of which a bit of cloth is tied, to indicate the position of the potato" (Wolcott 1935–545).

Conoderus bifoveatus Palisot de Beauvois, in the economic literature usually called *Monocrepidius* (or mis-spelled *Monocrepidus*), is the larger of these pests, of which the adults are found in the most varied of environments. In cotton fields, they hide during the daytime in cotton squares, or in the empty cocoons of *Alabama argillacea*. One sometimes finds them under the loose bark of trees, or hiding in opaque spider-webs, behind loose sugar-cane leaf-sheaths, and very rarely attracted to light. They fall a ready prey to *Bufo marinus*, to the local iguana and lizards, and Dr. Wetmore found that they had been eaten by Latimer's vireo, the wood pewee, the yellow warbler, the yellow-shouldered blackbird, the mozambique and the ani. Presumably *Conoderus bifoveatus* is the more common species, as most individuals in collections bear this identification label, but **Conoderus lividus** DeGeer, **C. memorabilis** Candeze and **C. pinguis** Candeze have also been recorded from Puerto Rico, all superficially indistinguishable except to the specialist. **Conoderus figuralis** Candeze and **C. sericatus** Candeze, as determined by Dr. M. C. Lane, occur on Mona Island, as noted by Prof. J. A. Ramos (1937–34), but we have no records of any from Vieques or Culebra, or any of the Virgin Islands.

Mr. R. H. Van Zwaluwenburg identified as **Heteroderes amplicollis**

Gyllenhal a beetle which Mr. D. L. Van Dine sifted from earth in 1912. Mrs. Raquel Dexter found in the stomach of a toad what was identified as **Heteroderes laurenti** Guérin-Méneville: Mr. Van Zwaluwenburg also identified as **Aeolus binotatus** Candeze a beetle which Mr. Van Dine found under cane trash at Arecibo in 1911. No more recent collections have been made of any of these three.

Dr. E. A. Schwarz identified as an **Aeolus** the beetle which was described in "Insectae Portoricensis" (1923–87), and in "Insectae Borinquenses" (1936–213) named **litoris,** from a pile of coconut husks at Arecibo. It has since been found in spider-webs on beach vegetation at Pt. Cangrejos, and intercepted by Mr. R. G. Oakley on mangrove and flowers of *Randia mitis* at Ponce. It is only 3.0 mm. long.

Drasterius elegans F., in local economic literature called an *Aeolus*, is 7.0 or 8.0 mm. long, and altho a much smaller species than *Conoderus bifoveatus*, is the much more serious pest of transplant tobacco in the mountains of Puerto Rico, where its larva is called "tijerilla." It is found in all parts of Puerto Rico, on Vieques and on Mona, the adults characteristically hiding in spider-webs, in cotton squares, in plant galls (as on the leaves of "ucar," *Bucida buceras*), and even burrowing in the excrement of *Laphygma frugiperda* in young corn. Remains of the adults were found by Dr. Wetmore in the stomach of the green heron, and Mrs. Raquel Dexter found that it is eaten by *Bufo marinus*.

Dicrepidius ramicornis Palisot de Beauvois, as tentatively identified by Mr. W. S. Fisher for Dr. Luis F. Martorell, who found it on Mona Island, is almost as large as a cucubano adult, but posteriorly it is acutely tapering. Specimens have been found at Mayagüez and at Maricao. Much smaller is **Ischiodontus** sp. "probably **anceps** Candeze," as determined by Dr. P. C. Ting, collected at Villalba.

Esthesopus paedicus Candeze, as identified by R. J. M. Valentine, was collected on Mona Island (Ramos 1947–34) and at Guánica, Ponce and Mayagüez. It is only an eighth of an inch long.

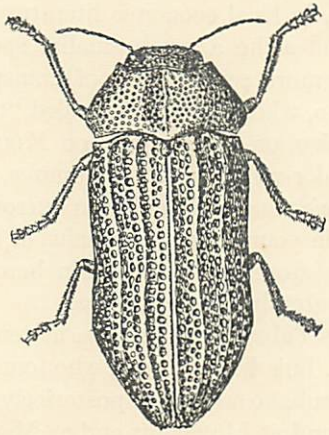
Trixagidae (Throscidae)

Drapetes chalybea was described from Puerto Rico by Carl E. A. Gerstaecker in "Die Arten der Gattung Lissomus Dalm." (Linn. Ent. Bol., **14:** 169. 1860), and Mr. R. G. Oakley found a beetle of this genus on *Mayepea* at Guánica.

Buprestidae: Flat-Headed Borers, or Metallic Wood Boring Beetles

Polycesta porcata F., the Haitian "bete d'argent," is one of the unfortunate accidental importations that have accompanied the unrestricted traffic in lumber from Hispaniola to Puerto Rico. How this could occur

is only too plainly shown by the discovery of a live larva of this Buprestid beetle burrowing out of a piece of mahogany furniture made from imported lumber. Presumably the insect is established in Puerto Rico, for adults have been collected at Salinas and Santa Isabel, in flight and resting on sugar-cane. It is the more serious pest because the larvae definitely attack trees of West Indian Mahogany (*Swietenia mahagoni*), as well as others of lesser value, feeding on the cambium when they are small, but penetrating to the heartwood as they approach full size. The adults are hardly silvery, as one might suppose from the Haitian common name, but darker and metallic greenish, or "aeneo-nigris, with a strong greenish and purplish tinge," according to Mr. W. S. Fisher in his "Revision of the West Indian



The Haitian "Bête d'Argent," *Polycesta porcata* Fabricius, twice natural size. (Drawn by Fritz Maximilien.)

Coleoptera of the Family Buprestidae" (Proc. U. S. National Museum **65** (2522): Art. 9, 1–207. Washington, D. C., 1925), who also notes: "This is one of the broadest species of the genus, averaging two and one-fifth times as long as wide." Even the smallest specimens found in Puerto Rico are three-quarters of an inch long, the largest measure all of an inch in length.

Polycesta thomae Chevrolat, black with metallic luster, was described from St. Thomas, subsequently collected by Dr. Stuart T. Danforth on Vieques, and more recently in considerable numbers on Mona Island, where Prof. J. A. Ramos found all stages in the dead branches of a beefwood (*Casuarina equisetifolia*). It does not occur in Puerto Rico. In addition to the difference in color as compared with *Polycesta porcata*, it may be distinguished, according to Mr. Fisher, because the "four costae on disc are distinctly elevated and the scutellar costae are entirely absent."

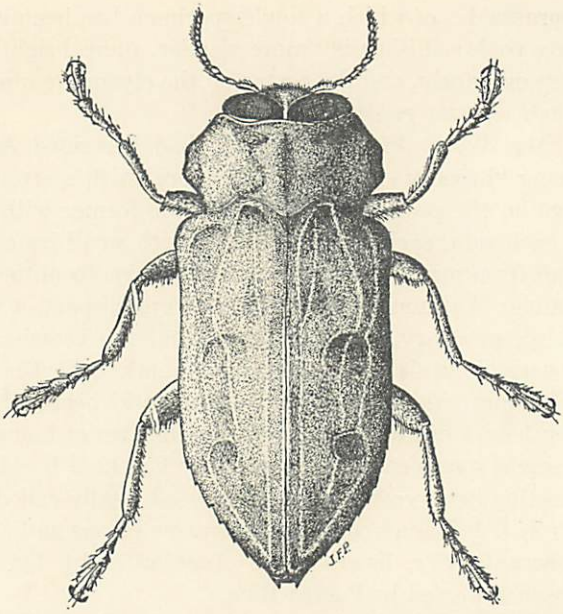
Polycesta depressa L., of which a single specimen has been collected at Ponce, according to Mr. Fisher is "more slender, more brightly colored, more acuminate posteriorly, and the costae on the elytra are more strongly elevated than in *Polycesta porcata.*"

Long before Mr. W. S. Fisher (1925–45) had described **Acmaeodera gundlachi** as being "broadly elongate, . . . aeneous, with a strong purplish or greenish tinge on the pronotum and elytra, the former with an oblong yellow spot on each side; each elytron ornated with small irregular yellow spots," the types from many coastal and mountainous localities in Puerto Rico, Dr. Alexander Wetmore had noted it as forming part of the food of the local kingbird, petchary, Latimer's vireo and the grossbeak. "This species is quite variable in size, form and elytral markings"; the type being 8.5 mm. long, 3.5 mm. wide. These little Buprestid beetles hide during the day between leaves of low weeds, or in the flowers of mangrove, ucar or sedges. A single specimen was collected by Dr. Luis F. Martorell on Mona Island, resting between the leaves of a weed locally called "té," and subsequently Prof. J. A. Ramos collected several on flowers and weeds there.

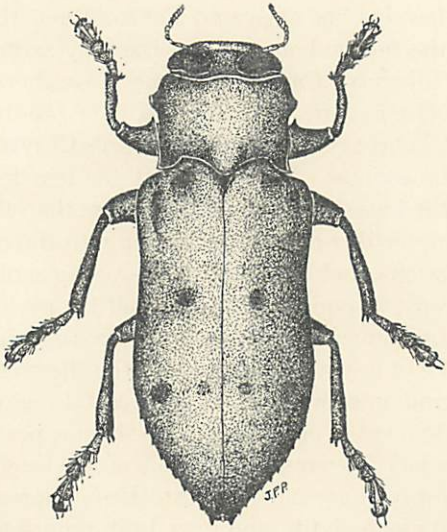
Buprestis decora Olivier, listed as an *Ancylochira* by Dr. Gundlach, has not since been collected in Puerto Rico.

Buprestis lineata F., listed by Drs. Stahl and Gundlach, is represented by one recently-collected specimen, found at Mayagüez in May 1933.

The Australian pine or beefwood tree (*Casuarina equisetifolia*) is attacked by comparatively few insects native to Puerto Rico, the endemic May beetles feeding on the foliage being almost the only serious pest. Dr. T. E. Snyder found "Injury to Casuarina Trees in southern Florida by the Mangrove Borer" (Jour. Agr. Research, **16** (6): 155–164, pl. 4, fig. 2. Washington, D. C., February 10, 1919), as he calls **Chrysobothris tranquebarica** Gmelin, to be serious. He found that the female beetle lays eggs in cracks or under the loose bark of small trees less than five years old, the larvae developing in, feeding on and burrowing into the cambium layer of the bark in all directions, and often killing the young sapling before reaching full size and ready to pupate. The normal life-cycle is completed in one year. Only a single such instance, at Vega Baja in 1930, has been noted in Puerto Rico of injury to beefwood, altho these trees and all kinds of mangrove are common everywhere in the coastal regions of the Island. This beetle is not known to occur in Cuba, altho a pest in Florida, and present in the Bahamas, Hispaniola and some of the Lesser Antilles. The adults are the largest of the genus in Puerto Rico, cupreous or aeneous in color, with deeply foveate elytra, and have been reported under a variety of names: *Chrysobothris impresa* F. by Drs. Stahl and Gundlach, *C. fraterna* described by Mannerheim, the type from Puerto Rico, and as *C. denticulata* Castelnau & Gory by Dr. Wetmore, who found it eaten by the petchary.



The Mangrove Borer, *Chrysobothris tranquebarica* Gmelin, five times natural size. (Drawn by José F. Pietri.)



The Aceitillo Borer, *Chrysobothris meqacephala* Castelnau & Gory, six times natural size. (Drawn by José F. Pietri.)

Adults are found resting on dead logs or stumps of trees, in the mountains as well as on the coast, altho presumably only small living saplings serve as food for the immature stages.

Chrysobothris megacephala Castelnau & Gory has a head which seems not exceptionally large, but certainly it is much broader between the eyes than in *C. tranquebarica*, and the smaller beetle has no such deeply sculptured foveae, thus making more prominent the "four round, deep impressions" on each elytron. It was collected on Mona Island by Prof. J. A. Ramos, and occurs in Hispaniola as well as in Puerto Rico, the observed hosts of the larvae being "gallito" (*Agati grandiflora*), reared by Mr. E. G. Smyth, and the valuable cabinet wood "aceitillo" (*Zanthoxylum flavum*), reared by Dr. Luis F. Martorell, both records from Guánica.

Chrysobothris dentipes Germar, as identified for Dr. Stuart T. Danforth (Mayagüez vi–32), may be presumed to be in error, for Mr. W. S. Fisher in his "Revision of the North American Species of the Buprestid Beetles belonging to the Tribe Chrysobothrini" (Misc. Pub. No. 470, U. S. Dept. Agr., pp. 275, fig. 126, ref. 11. Washington, D. C., September 1942) says of this species that it is "restricted to coniferous trees," of which none occurs in Puerto Rico.

Chrysobothris thoracica described by Fabricius as a *Buprestis* from St. Thomas, has subsequently been collected at Ponce and Guánica in Puerto Rico. The beetle is scarcely a fifth of an inch long, short, robust, "head bright green, with the reliefs on front cupreous; pronotum reddish-cupreous with anterior margin aureous; scutellum dark green, elytra brownish-aneous, with nile-green markings."

Chrysobothris wolcotti, described by Mr. W. S. Fisher (1925–119 to 121), the type from Mayagüez, others from Añasco and Río Piedras, was found by Dr. Stuart T. Danforth to form part of the food of the grackle and the flycatcher, and it is doubtless eaten by other birds as well. It is slightly larger than *C. thoracica*, has a similar bright green head, but each elytron is ornated with bright green markings. Dr. Gundlach referred to it as *C. lepida* C. & G., a Cuban species. Adults have been collected in all parts of Puerto Rico, and Dr. Luis F. Martorell found the larvae with characteristic flattened and enlarged thorax abundant in the trunks of the ornamental crape myrtle, *Lagerstroemia indica*.

Neotrachys hoffmani, one of the "New West Indian Buprestidae (Coleoptera)" (Proc. Ent. Soc. Washington, **32** (7): 125–129. Washington, D. C., October 1930) described by Mr. W. S. Fisher, is only 3.0 mm. long, the type from Puerto Rico, "allied to *guadeloupensis*, but differs in being subopaque, uniformly dark bronzy green above, broadly elongate and not so strongly narrowed posteriorly." Mr. R. G. Oakley subsequently found another on areca palm at Adjuntas.

Peronaemis cupricollis was described by Mr. W. S. Fisher as one of some "New Buprestid Beetles from Mexico, Central and South America, and the West Indies" (Proc. U. S. National Museum, **99** (3240): 327–351. Washington, D. C., 1949). The type was collected by Prof. J. A. Ramos at Indiera Alta, Maricao, being 11 mm. long, 3.5 mm. wide, "broadly agriliform, broadly rounded in front, strongly narrowed posteriorly, glabrous and rather strongly shining; head green, pronotum reddish cupreous, elytra olivaceous-green, body beneath uniformly bronzy green, with a distinct purplish tinge."

A single Buprestid collected at Indiera, in the mountains between Yauco and Maricao, is considered by Mr. W. S. Fisher to be possibly a new species of **Peronaemis.**

Taphocerus elegans was described by Mr. W. R. Fisher (1925–187) from a single specimen collected by Dr. Richard T. Cotton on El Yunque. Later, Mr. R. G. Oakley found another on chinaberry at Adjuntas.

Micrasta oakleyi, named after its collector by Mr. W. S. Fisher as one of "Two New Buprestid Beetles from Puerto Rico" (Proc. Ent. Soc. Washington, **37** (2): 30–32. Washington, D. C., February 1935), is from Ponce, "smaller (than *cubensis*), glabrous, and uniformly brownish cupreous, the marginal carina on each side of the pronotum entire," found on *Trophis racemosa*. What Dr. Luis F. Martorell found under castor bean leaf on Mona Island is considered by Mr. Fisher to be near this, or a new species.

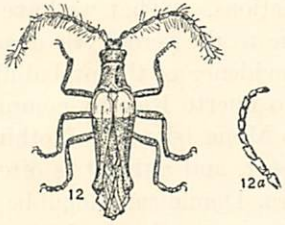
Micrasta ornata Fisher (1935–31), the type from Guánica, has "elytra ornamented with violaceous black spots, the marginal carina on each side of the pronotum obliterated anteriorly, and the elytra depressed deeply along the base." No collection has been made since that of the type by Mr. R. G. Oakley.

Micrasta puertoricensis was described by Mr. W. S. Fisher (Psyche **46** (4): 163–4. Cambridge, December 1939) from a single specimen collected by Dr. P. J. Darlington in the Maricao Forest at an elevation of 3,000 feet. Like others of the genus, it is very small, only 1.25 mm. long and 0.6 mm. wide, and "resembles *Micrasta oakleyi*, but differs in being uniformly black, with indistinct bronzy-green tinge."

Lycidae: Net-Winged Beetles

"The Lycidae, Lampyridae and Cantharidae (Telephoridae) of the West Indies" are comparatively well known because of this publication (Bulletin American Museum of Natural History, **46** (8): 413–499, fig. 65. New York, August 24, 1922) by Dr. Charles W. Leng and Mr. Andrew J. Mutchler, and their subsequent papers. They established the tribe Leptolycini and the included genus for the little black beetle, only 3.0 mm. long, with basal fifth of elytra yellow, named **Leptolycus heterocornis,**

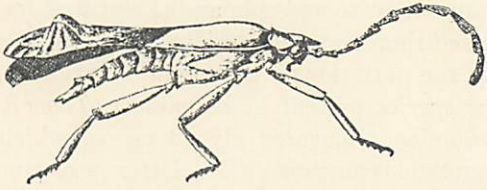
from Aibonito and Cayey. It has since been found at Villalba and Prof. J. A. Ramos has specimens from Maricao, Consumo and the mountains back of Mayagüez, all localities in the mountainous interior of Puerto Rico. Of the holotypic female with the color of the thorax and scutellum yellow, from Aibonito, to which Leng & Mutchler gave the varietal name **flavicollis,** Prof. Ramos also has specimens from the type locality.



Leptolycus heterocornis Leng & Mutchler, male, eight times natural size. 12*a* antenna of female. (After Leng & Mutchler.)

Lycids of the genus *Thonalmus* "are all elongate, glabrous insects, with long, feebly serrate antennae and subparallel elytra, usually bearing three more or less elevated ridges or costae. The elytra are of a brilliant orange or red color, with the posterior portion metallic green or violet." Of the two red and blue species present in Hispaniola, *Thonalmus dominicensis* Chevrolat has prominent elevated elytral crests, which are lacking in **Thonalmus chevrolati** Bourgeois. The latter was noted by Leng & Mutchler (1922–422) as present "in Porto Rico by commercial introduction only—at Guanica, April in boat-load of cane from Higuera (R. H. Van Zwaluwenburg)," but when questioned many years later, he could not remember whether his specimens were collected near the pier at Guánica where the cane boats from Santo Domingo landed, or dead in the hold of the boat after its load of cane fumigated with sulfur had been transferred to the empty waiting cane cars. Dr. Gundlach has no record of this strikingly obvious insect from Puerto Rico altho Dr. Stahl, possibly in error, records it as *Calopteron suave* J. Duval. The first authentic collections of live beetles in Puerto Rico were made by Mr. Felipe Mora at Hormigueros, August 1, 1932, reported but incorrectly identified by Dr. Stuart T. Danforth as *Thonalmus dominicensis.* In September 1936, adults were found in abundance in one field of young plant cane at Hda. María Antonia at Guánica, and in succeeding years others were found in cane fields as far east as Ponce by 1941. "In March 1940, a single beetle was collected at Hda. Victoria, between Coloso and Aguadilla, and several were noted in the same or adjacent fields in April and July," as reported in "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields"

(Jour. Agr. Univ. P. R., **27** (2): 85–104, fig. 12, ref. 16. Río Piedras, June 1944). In December 1939, a single specimen was found at Isabela, and in December 1943 one was collected in the mountains at Lares. Establishment in Puerto Rico had unquestionably occurred long before, presumably before 1930. If the beetle had come in on boat-loads of cane from Santo Domingo, as is most probable, it must have arrived before 1930, for it was in this year that the importation of cane ceased, due to federal quarantine restrictions. "That we have not found this beetle on Mona Island may be due to the xerophytic character of the Island, or it may furnish additional evidence of the probability of the introduction of *Thonalmus chevrolati* into Puerto Rico by commerce, for there is little or none from Hispaniola to Mona Island." Nothing is known as to the immature stages of the insect, and altho it is often noted in cane fields at La Romana and Higuera, Dominican Republic, we do not know if it in any way depends on sugar-cane. In captivity, the adults do not eat the eggs of *Diatraea saccharalis* F., and Mr. H. S. Barber is of the opinion that neither larva nor adult is predaceous.



The Lycid Beetle, *Thonalmus dominicensis* Chevrolat, four times natural size. (Drawn by Fritz Maximilien.)

Lampyridae: Firefly Beetles

Nearly a dozen fireflies are recorded from Puerto Rico, of which half are quite common, especially in citrus and coffee groves, and in virgin forest at the higher elevations, but some occur abundantly in even the most xerophytic coastal regions.

Lucidota marginipennis, described by Leng & Mutchler (1922–438) from Aibonito, has not since been collected.

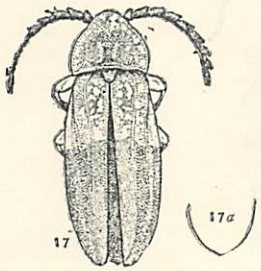
The elongate **Callopisma borencona** Leng & Mutchler (1922–440), "yellow, with apical two-thirds of elytra, tibiae and antennae black," is comparatively common. It has been repeatedly collected in grapefruit groves along the north coast, in coffee groves in the mountains and on the tree ferns of El Yunque and found to be an item in the food of lizards of these environments.

The broadly oval **Callopisma emarginata** Leng & Mutchler (1922–443), described from specimens collected at Mayagüez and in the mountains of

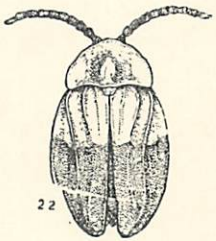
the western part of the Island, "reddish yellow, apical half of elytra, antennae and tibiae black," has since been found as far east as Rio Piedras.

Callopisma miniatocollis Chevrolat is listed from Puerto Rico by Dr. R. E. Blackwelder (1945–355), as is also **Callopisma rufa** Olivier, in synonymy with the *Lychnuris dimidiatipennis* J. Duval. The latter name was listed by Dr. Stahl, and as a *Callopisma* by E. Olivier in his "Contribution a la Faune Entomologique des Antilles Lampyrides" (Rev. Sci. du Bourbonnais et du centre de la France, **25**: 19. 1912).

Lecontea galeata, described from St. Thomas and Puerto Rico by E. Olivier (Bul. Soc. Zool. France, **24**: 91. Paris, 1899), was reported from Vieques by Leng & Mutchler (1922–453), and is found in all parts of Puerto Rico, even the dryest, as well as in the mountains. It is possibly the largest firefly in Puerto Rico, dark grey to black above, prothorax broadly and elytra narrowly margined with yellow. Mr. August Busck collected



Callopisma borencona L. & M. (After Leng & Mutchler.)



Callopisma emarginata L. & M. (After Leng & Mutchler.)

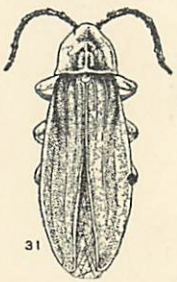
it at Fajardo, Arroyo and Aguadilla, and he is responsible for the collection on Vieques Island.

What Motschulsky described from Puerto Rico (1853–42) under the name of *Rabopus roseicollis*, "thorax red at middle; yellowish at margin, without spots; head, base of antennae, and the palpi, legs and the whole border of the elytra yellowish white," re-described by Leng & Mutchler (1922–436) as *Lucidota decorus* (Gemminger & Harold), being thus placed because the antennae are strongly serrate, is now listed as **Photinus decorus** Motschulsky. Mr. August Busck collected this at Bayamón, and it has since been found in grapefruit groves at Vega Alta and Río Piedras, but it is more typically a mountain species: from El Duque at Naguabo, and Jájome Alto, and in the higher coffee groves, being so abundant as to form an appreciable item in the food of *Anolis evermanni* and *Anolis cristatellus*.

Photinus dubiosus, described by Leng & Mutchler (1922–461) as known only from Puerto Rico, is considerably larger, 9.0 to 10.0 mm. long, "oblong,

greenish, becoming pale testaceous in drying," resembling *Photinus glaucus* of Cuba and Hispaniola, but "much darker in color beneath." Indeed, it was under the name of *Photinus glaucus* that Dr. Alex. Wetmore recorded finding this firefly eaten by the yellow warbler, the yellow-shouldered blackbird and the oriole. It is also eaten by the lizards *Anolis evermanni* and *Anolis krugii*. It has been found in the most xerophytic parts of Puerto Rico: on cotton plants at Boquerón and at light at Hda. Santa Rita, Guánica, as well as in coffee and orange groves and virgin forest in the mountains.

Photinus heterodoxus, described by Leng & Mutchler (1922–457) from females from Farjardo and Adjuntas as "elongate, 12.0 mm. long, parallel; yellowish above and beneath, the eyes only black," has not since been found.



Photinus triangularis E. Oliver. (After Leng & Mutchler.)

The type of **Photinus triangularis** E. Olivier (Ann. Soc. Ent. Belgique, **56:** 25. Bruxells, 1912) is from El Yunque, and other specimens of this large, dull yellowish or golden-brown firefly, 13.0 mm. long, have been collected there. Mr. H. S. Barber, in a note accompanying the identification of the latest collection (November 30, 1944) states that "this does not belong to the genus *Photinus*, but in the genus *Diphotus* as now understood." Mr. August Busck collected this beetle on Culebra Island, altho the highest elevation there, Mt. Resaca, is only 650 feet high, and in recent years it has been covered with sugar-cane almost to the top.

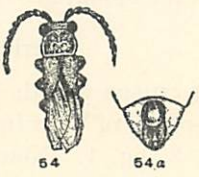
Photinus vittatus G. A. Olivier is possibly the most abundant of all the fireflies in Puerto Rico, only 7.0 mm. long, "narrow, subparallel in form; pronotum yellow with carmine disc, elytra brown with narrow subsutural vitta often joining the broader outer testaceous margin." Certainly it is more common at the lower elevations, coming to light at all times of the year at Río Piedras and Guánica. Dr. Wetmore found it eaten by the cliff swallow, the petchary, the vireo and several warblers, while the crested

lizard, *Anolis cristatellus*, also succeeds in finding it, despite its normally nocturnal habits.

Cantharidae (Telephoridae): Leather-Winged Beetles

Tylocerus barberi, dedicated by Leng & Mutchler (1922–497) "to our friends and colleagues, Herbert S. Barber of Washington and Harry G. Barber of New York," is an elongate, yellowish-brown beetle, 7.5 to 9.5 mm. long, the pronotum yellow and subquadrate, the elytra blackish-brown, margined with yellow, and with two narrow yellow stripes. The type is from Manatí, but it is common everywhere in coastal Puerto Rico, and in the mountains as at Cayey, Aibonito and Villalba, being most often attracted to light. Prof. J. A. Ramos collected one specimen at light on Mona Island. The greatest number of these beetles observed was on watershoots of an unidentified tree at Barceloneta, June 8, 1916, many being in coitu.

Tytthonyx cavicornis L. & M. (After Leng & Mutchler.)



Tytthonyx discolor L. & M. (After Leng & Mutchler.)

Tylocerus bilineatus was described by Maurice Pic in his "Neue Malacodermen" (Zool. Anz., **76** (3/6): 95–98. Hamburg, 1928) from Puerto Rico.

Tytthonyx discolor, described by Leng & Mutchler (1922–490), the type from Aibonito, others from Desecheo Island collected by Dr. Frank E. Lutz, is a little elongate black beetle with elytra only partly covering the abdomen. The type is 3.25 mm. long, but those from Desecheo are smaller, 2.5 to 2.75 mm. in length, and paler thruout, being "dark brown rather than black." Subsequent collections have been made from Lares and Camuy.

Tytthonyx cavicornis, described by Leng & Mutchler (1922–489) from an elongate brownish holotype from Mona Island, 3.0 mm. long, has since been collected there in April and June by Prof. J. A. Ramos (1947–33), "swept from shrubs on the plateau."

Mr. Howard E. Hinton described "A New Species of West Indian **Tytthonyx** (Col. Cantharidae)" (Pan-Pacific Ent., **10** (1): 30–32. San

Francisco, 1934) from Puerto Rico under the name **bicolor**, and included a key for the separation of the five known West Indian species. Three additional species, "mostly red or yellowish red in color, with the black underwings protruding from beneath the short elytra," have since been found in Cuba (American Museum Novitates No. 924, pp. 5, fig. 5. New York, May 4, 1937).

Dasytidae (Melyridae): Soft-Winged Flower Beetles

Mr. G. E. Bryant determined two small flea-beetle-like insects collected at Pt. Cangrejos on cotton bolls to be a species of *Alymeris*, now called **Melyrodes**. Prof. J. A. Ramos (1947–33) reports collecting one such, as determined by Mr. H. S. Barber, on the beach of Mona Island, at Sardinera.

Mr. H. S. Barber gives the names of **Attalus** spp., or **Anthocomus** spp., to similar small beetles intercepted by Mr. R. G. Oakley on banana leaves in the mountains back of Ponce, and on the flowers of *Inga laurina* at Indiera in the mountains back of Yauco.

Cleridae: Checkered Beetles

Callotillus crusoe was the name given by Mr. A. B. Wolcott to one of "Two New species of West Indian Cleridae" (American Museum Novitates No. 59, pp. 3, fig. 1. New York, February 14, 1923), a slender black beetle, the apical half of its elytra pale yellow, collected on the ground at Camuy. The specific name was chosen, not because Robinson Crusoe had anything to do with Puerto Rico, but as this was the only Clerid at that time known here, and that but a single specimen, it seemed as lonesome as Crusoe on his tropical island. Dr. Gundlach, however, had reported **Opilo unifasciatus** as determined by Chevrolat. More recently Mr. R. G. Oakley has collected what Dr. E. A. Chapin identified as species of **Epiphloeus** on flowers at Ponce, and of **Phyllobaenus** at Guánica. Under the bark of a dead flamboyán (*Delonix regia*), another Clerid with a transverse yellow stripe across the dark brown elytra has been found at Río Piedras.

Indeed, more intensive collecting would doubtless produce more than a month of Fridays, even if not including the abundant **Necrobia rufipes** DeGeer. This is a not-so-slender but typically hairy, bright, iridescent blue beetle, collected at Mayagüez in December 1939 by Mr. H. Ayguabibas on dried meat. Even earlier than this it had been found resting on cucumbers at Loíza, and Prof. J. A. Ramos (1947–33) on Mona Island collected "numerous specimens on decaying fish at Sardinera Beach, March 6, 1944, and others on a dead goat on the plateau, April 7, 1944."

The cosmopolitan **Necrobia ruficollis** F., greenish-blue with basal fourth

of elytra and legs red, has been found at Mayagüez in abundance by Prof. J. A. Ramos on old cheese imported from Argentina.

Temnochilidae (Ostomidae, Trogositidae, Ostomatidae)

Temnochila portoricensis, described by A. Leveille (Ann. Ent. Soc. France, **76:** 401. Paris, 1907), and **Temnochila aenea** Olivier are sufficiently abundant in forests, even if not in collections, to furnish food for the woodpecker, as reported by Dr. Alex. Wetmore.

Mr. W. S. Fisher determined as a species of **Airora** the Ostomid beetles which Mr. R. G. Oakley found under the bark of a dead tree at Guánica.

Tenebroides transversicollis J. DuVal, listed by Dr. Gundlach as a *Trogosita*, has since been collected under bark of *Inga vera* at Cayey, and with no host records, at Barranquitas, Hatillo, Mayagüez and San Germán.

Tenebroides punctulata Chevrolat, listed from Puerto Rico by Herr Edmond Reitter in his "Die Sud- und Mittel-Americanischen Arten der Gattung *Tenebroides* Piller & Mitterpacher" (Verh. Nat. Ver. Brünn für 1874, **13:** 74. 1875), is in confirmation of its listing as a *Trogosita* by Dr. Stahl. It was of this or the preceding species of which Dr. Donald De Leon found larvae and pupae under the bark of various trees at various localities, and the remains of adults of which Dr. Alex. Wetmore had reported eaten by the woodpecker and the tody.

Quite different in habits is the "cadelle," **Tenebroides mauritanica** L., a cosmopolitan pest of stored products, observed in Puerto Rico with the larvae feeding on rice and sunflower seeds. Adults have been collected at light on Mona Island, at Camp Kofresí, but it remains to be seen if the species can continue to exist there when Mona is no longer inhabited by man. It is possibly the largest beetle which feeds on stored products, being three-eighths of an inch long, shining, dark brown and quite flattened.

Dermestidae: Larder Beetles

Only by the most unremitting care are collections of insects and natural history specimens preserved from the attack of Dermestid beetles, especially in the tropics. Thus it is but natural that Drs. Stahl and Gundlach should list **Dermestes carnivora** F., and *Dermestes vulpinus* F., now called **Dermestes maculata** DeGeer, altho neither has since been found in any great abundance: the former at Lares, the latter on the docks at San Juan. **Dermestes ater** DeGeer, originally identified from Puerto Rico as *Dermestes cadaverinus* F. by Dr. E. A. Schwarz, appears to be much more common recently, with many records from all parts of the Island, those from Mayagüez being on sausage and preserved meat.

Dermestes canina Germar, as determined by Mr. H. S. Barber, was

found on Mona Island by Dr. Luis F. Martorell: larvae, pupae and adults being present in abundance on goat skins being dried and also feeding on the fragments of flesh inside turtle shells on the beach. Prof. J. A. Ramos (1947–35) found them on dead fish at Sardinera Beach.

Attagenus piceus Olivier, the cosmopolitan "black carpet beetle," elsewhere known as a common museum and household pest, in Puerto Rico was first found on cotton plants at Quebradillas, as determined by Dr. E. A. Schwarz, and Prof. J. A. Ramos has since collected these small black beetles at Isabela and Mayagüez. Numerous interceptions of undetermined species of this genus were made at San Juan.

Attagenus gloriosae F., as identified by Mr. H. S. Barber, has been collected by Prof. J. A. Ramos at Río Piedras, Ponce and Mayagüez.

Globicornis fulvipes Guérin-Méneville, listed by Drs. Stahl and Gundlach as a *Trogoderma*, has been repeatedly collected since, most recently feeding on dead butterflies. They also list **Trogoderma insularis** Chevrolat, which has since been collected in the field, at Loiza and at Bayamón.

Eucnocerus anthrenoides Sharp, as identified by Mr. H. S. Barber, has recently attacked the insect collection of the College of Agriculture at Mayagüez.

One or more species of **Cryptorhopalum** were found by Dr. Alex. Wetmore to have been eaten by warblers, and numerous subsequent collections, identified only to "sp." or "sp. nov." have since been made from the flowers of various trees: guácima, capá prieto and guamá, as well as from jasmin and sedges.

Bostrychidae: Powder-Post Beetles

"**Rhizopertha dominica** F. as a Library Pest" by Dr. W. A. Hoffman (Jour Ec. Ent., 26 (1): 293–4. Geneva, February 1933) appears to be the first record of these little yellowish-brown powder-post beetles attacking the inner portion of the back of books, altho they have since been intercepted in chicory beans and in dry chick peas at San Juan. Under the name of *Rhizopertha pusilla* F., Leng & Mutchler record the same insect as a "cosmopolitan species, or introduced from the United States in timber." It is by no means the only beetle or other insect pest which attacks books in the tropics, but the effectiveness of fumigating with cyanide at the rate of 10 pounds of Cyanogas to 10,000 cubic feet, recommended by Dr. Hoffman for the library of the School of Tropical Medicine, will doubtless be equally successful if used elsewhere against this or any other of the insects attacking books.

Dinoderus minutus F., a short little cylindrical, yellowish Bostrychid beetle, has been found in great abundance in flour, and feeding on sweet

corn seed, as well as in the trunks of upright dead trees and in the stems of dead gandul bushes. These are comparatively incidental and accidental deviations, however, from its normal habit of attacking bamboo when dry, and most injuriously when the bamboo has been made up into furniture or novelties for tourists. As such it has received the almost undivided attention of Mr. H. K. Plank for a considerable number of years, the results of his investigations being summarized in the annual reports of the Mayagüez Station from 1936 to date. The common *Bambusa vulgaris* is much more susceptible to attack than some other relatively resistant or nearly immune species, as is shown in "The Relation between Curing and Durability of *Bambusa tuldoides*" (Caribbean Forester, **7** (3): 253–273. Río Piedras, July 1946), by David G. White, Milton Cobin and Pedro Seguinot Robles. Indeed it has not been possible for Mr. Plank to secure complete immunity of *vulgaris* until he tried "DDT for Powder-Post Beetle Control in Bamboo" (Science, **106** (2753): 317. Baltimore, October 3, 1947), of which "one thorough brushing with a kerosene solution at the 5 percent residual strength resulted in 94 percent control." His studies on the "Biology of the Bamboo Powder-Post Beetle in Puerto Rico" (Bulletin No. 44, Federal Expt. Station, Mayagüez, pp. 29, fig. 19, ref. 13. Washington, D. C., May 1948) showed that "development from deposition of the egg to emergence of the adult averaged 51 days."

Heterarthron gonagrum F., a much larger, darker and more elongate Bostrychid beetle, three-eighths of an inch long, is present in all the Greater Antilles and in most of the Lesser Antilles as far south as St. Vincent. All the local records are from the more xerophytic part of the Island: Mr. E. G. Smyth having reared it from mesquite or "bayahonda" (*Neltuma* or *Prosopis juliflora*) at Guánica, Dr. Luis F. Martorell from "burro" (*Capparis flexuosa*) at Santa Isabel, and Prof. J. A. Ramos (1947–40) on Mona Island "boring in casuarinas."

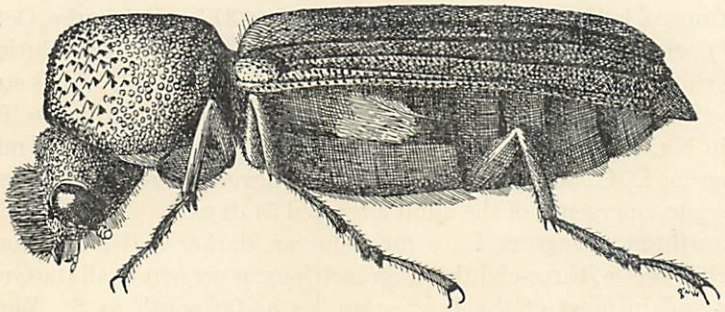
Xylomeira torquata F., quarter of an inch long, has a similar distribution, Dr. Luis F. Martorell having collected many specimens at light on Mona. Dr. Stuart T. Danforth reared it from a dead tamarind tree near Ponce, and it has been found infesting the dead branch of an unidentified leguminous tree at Coamo.

Tetrapriocera longicornis Olivier (= *T. tridens* F.), listed by Dr. Gundlach as a *Xylopertha*, with continental as well as West Indian distribution, but restricted to a xerophytic environment, was noted in great abundance at light at Guánica by Mr. E. G. Smyth in October 1913, and Prof. J. A. Ramos found a single specimen attracted to light on Mona Island in April 1944. The crested lizard, *Anolis cristatellus*, at Boquerón was found to have eaten these beetles.

Xylobiops floridanum Horn, as determined by Mr. W. S. Fisher, was reared by Dr. Luis F. Martorell from a dead branch of "burro" (*Capparis flexuosa*) at Santa Isabel.

Xylobiops parilis Lesne, previously known from Mexico, has been collected at Tallaboa, Puerto Rico, according to Prof. J. A. Ramos.

From their lateral appearance of perpetually bowed head, suggesting the devotion of priests, Fabricius gave the names of religious orders to what he considered the various species of *Apate*, but his *francisca* and *carmelita* are now thought to be only synonyms of **Apate monacha**, present in Africa as well as in the West Indies. These are large beetles, five-eighths of an inch long and three-sixteenths wide, cylindrical, dark brown and heavily chitinized, rarely coming to light, but most often found in the dead or dying trunk of a small tree in which each beetle has made a separate tunnel.



The Bostrychid Beetle, *Apate monacha* Fabricius, five times natural size. (Drawn by G. N. Wolcott.)

It "starts obliquely from a node in the tree where the small branches come out, but curves upward when the center of the slender tree is reached, and is discontinued just before joining the next tunnel. Alternate tunnel entrances are on opposite sides of the sapling, indicating that the beetles are possibly less social in their habits than might at first appear." "The female beetle lays her eggs in the tunnel of the tree which she and her companions have killed, as the larvae require the wood of freshly killed trees for their nourishment." Infestations most often develop in coffee groves, or plantations of mahogany, where the brush and small trees, cut down where the more valuable trees are to be planted, has been left lying about to furnish food for the initial generation of *Apate*. The beetles developing from this valueless brush, which should have been burned if no other use could have been found for it, then attack the economic trees and may cause serious losses before the death of the smaller trees indicates what is happen-

ing. If the infested trees already dead are of no particular value, the simplest method of killing the beetles is to cut down the trees and burn them. If the trees are alive and valuable, the beetles may be killed in their tunnels by means of a No. 6 or No. 8 soldering wire. These wires are strong enough to pierce the beetles, yet sufficiently flexible to bend according to the curve of the tunnels. Their use is entirely practical, as has been proved by extensive use.

Under the name *Apate carmelita* F., both Dr. Stahl and Dr. Gundlach recorded the presence of this pest, the latter adding, "Es dañino a los árboles, perforando la larva, los troncos y ramas." Mr. R. H. Van Zwaluwenburg thought the insect exceptionally injurious around Mayagüez in the year 1915, and it is true that most records of injury are from the Mayagüez region or the western part of the Island, the farthest east being at Bayamón in 1923 and at Río Piedras in 1912. He recorded it as attacking mahogany, coffee, grapefruit, citron, pomelo, gandul, flamboyán, willow and hueso (which may have been *Linociera* (or *Mayepea*) *domingensis*, or *Picramnia pentandra*). Additional recorded hosts are tamarind, quenepa, guava, aguacate, pomarrosa, achiote, mangle, ucar, beefwood and cultivated grape vines. Mr. H. Bourne, of Guánica Centrale, found a cane stalk at Limón infested with thirty beetles, but attack on sugar-cane is very exceptional. Even such short-lived plants as Sea Island cotton may be attacked, and sometimes the diameter of the infested sapling tree is so small that most of its woody interior is eaten away to make a tunnel large enough to contain the beetle. Rarely can such plants recover, but if the beetles have been killed, larger trees eventually outgrow the injury.

Lyctidae: Powder-Post Beetles

The Lyctid powder-post beetles are small, elongate and slender, somewhat flattened as compared with the cylindrical Bostrichids, larger and more impressive, but they are possibly even more destructive, and convert an even larger part of their host to powder.

Lyctus aequalis Wollaston, as identified by Mr. W. S. Fisher, has been intercepted at light in San Juan.

Lyctus caribeanus Lesne has been reported as attacking stored bamboo at Mayagüez, and as infesting almácigo logs at Guayama.

Lyctoxylon japonum Reitter is an oriental species, identified in 1921 by Dr. E. A. Schwarz from Puerto Rico, where large numbers were attracted to light at Río Piedras, having come from native baskets that were eventually so completely destroyed that nothing remained of them but a mere shell, and a large heap of fine yellow powder. They were parasitized by Pteromalid wasps, identified by Mr. S. A. Rohwer as a species of *Neo-*

catolaccus, and possibly for this reason the beetle has not been noted generally as a serious pest since. Indeed, the only other local record is of occurrence in the branch of a leguminous tree at Coamo, two years later.

Trogoxylon curtulum Casey, as identified by Mr. W. S. Fisher, also attacks native baskets, and has been reared from almácigo logs, but is of greatest importance as a pest of the sapwood of mahogany, *Swietenia mahagoni*. When an attempt is made to cover up the deception of incorporating sapwood in furniture supposed to be all heartwood, by heavy staining with potassium bichromate, the emerging beetles come out through both stain and varnish, leaving telltale holes and little piles of very fine powder. Very definitely, they do not breed in mahogany heartwood, and if the furniture is guaranteed to be entirely and exclusively of heartwood, their emergence will prove the sustitution of sapwood.

Ptinidae: Spider Beetles

Dr. Alexander Wetmore reported the remains of a species of **Ptinus** as eaten by the northern parula warbler, but this is the only record of a representative of this family from Puerto Rico.

Anobiidae: Drug Store Beetles

Stegobium panicea L., the tropicosmopolitan "drug store beetle," has been collected at light at Mayagüez. This is the only familiar Anobiid which Mr. W. S. Fisher identified from Puerto Rico out of the abundance of material collected here by Mr. R. G. Oakley, which was found to consist of eight new species. His descriptions of these eight new species were published in "Insectae Borinquenses" (1936–238 to 242).

Trichodesma oakeyi Fisher (1936–238) is a "very robust, brownish black, moderately shining Anobiid, "the whitish pubescence on each elytron forming a more or less distinct spot at middle and a smaller spot along sutural margin near apex." It is 5.5 mm. long, 3.0 mm. wide, the type from Aibonito. Dr. Donald De Leon, while conducting his two months survey of the forest insects of Puerto Rico, found this or other species of *Trichodesma* under the bark of mahogany and ucar at Guánica.

Lasioderma serricornis F., "la Carcoma del Tabaco," a cosmopolitan pest of stored tobacco, was first definitely identified locally by Mr. D. L. Van Dine in 1921, when found attacking the binding of books. It seems to be especially attracted to the kind of stiff cardboard used for the binding of books, or for luggage in imitation of leather, and has also been collected in Puerto Rico in packaged chocolate, in ginger, and in pepper. Stored garden seeds are often found infested, possibly the most interesting example of attack on seeds being on camándula beads, the hard grey seeds of *Coix lachryma-jobi*. Not only did the adults and developing larvae eat the

interior of these seeds, but when strung on a thread to form a portiere, the thread was so often severed as to greatly discourage the person industriously engaged in re-stringing them. Cotton seed and cotton seed meal are notoriously subject to attack, as is also tobacco seed, but the principal economic host is stored tobacco.

In the older economic literature, *Lasioderma serricorne* is called the "cigarette beetle," altho as a matter of fact one rarely finds cigarettes attacked, the injury to cigars being much more common, and "tobacco beetle" seems a more suitable name. The beetles themselves cause comparatively little damage, for they rarely eat enough to be noticeable, but it is the tunnels and the dusty powder resulting from the activities of the larvae that are chiefly objectionable. In made-up cigars, such holes render the product unsaleable. Dr. W. D. Hunter once said of gift cigars from Havana that heavy infestation indicated the quality of the cigars, but this was cold comfort to the unfortunate giver. Injured cigars do not draw well, burn unevenly, and dust is drawn into the mouth of the smoker. Infestation may occur at any time: from the time the green tobacco is hung up in the drying shed until the finished product is in the hands of the consumer. The dust-filled cracks and crevices of old tobacco factories, and piles of discarded refuse are almost invariably infested with all stages of this small beetle, and in one case in Puerto Rico, an exceptionally heavy infestation developed in tobacco hung in a drying shed in which was stored infested cotton seed meal, intended to be used for fertilizer.

Mr. Joseph N. Tenhet, inspecting tobacco storage warehouses in Puerto Rico in August 1949, found practically no live adults. On compiling the records of injury on file at the Río Piedras Station, it was found that practically all were during the winter and early spring, with none for the summer and autumn months. Apparently summer temperatures prevent injury, while winter temperatures, especially in the mountains, are much more favorable for the development of this pest. This suggests that as a practical measure of control, storage at temperatures varying considerably from those of winter in Puerto Rico might be reasonably effective.

Neither Dr. Stahl nor Dr. Gundlach note the presence in Puerto Rico of *Lasioderma serricorne*, and it seems hardly possible that it could have been present and they did not have its damage brought to their attention. In 1910, however, Mr. W. V. Tower, at the Mayagüez Station, reported "a beetle borer in tobacco warehouses" and started his experiments in fumigation with cyanide which eventually resulted in his taking over the commercial fumigation for the Porto Rico-American Tobacco Co. At the present time, the beetle may be presumed to be in all parts of the Island. The adult is from 2.2 to 3.0 mm. long, elongate-oval, moderately convex, uniform dull reddish-yellow or brownish-red, with a fine uniform recumbent

pubescence on the entire body. The segments of the antennae are triangular, all except the first of approximately of the same size, and not as in *Stegobium panicea*, with the terminal three much larger than the others. The whitish larva is almost as hairy as a Persian kitten, and when fully-grown and about to pupate, compacts its excremental dust into a definite pupation chamber. Possibly the best technical and economic account is "The Tobacco Beetle: an Important Pest in Tobacco Products" (Professional Paper) Bulletin No. 737, U. S. Dept. Agr., pp. 77, fig. 16, pl. 3, ref. 90. Washington, D. C., March 17, 1919) by Mr. George A. Runner.

Petalium puertoricensis Fisher (1936–239) is only 1.22 to 1.75 mm. long, 0.5 to 0.75 mm. wide, "moderately elongate, subopaque, uniformly reddish brown," the type from dead wood or live "ucar" or "moca" trees in the mountains north of Ponce, intercepted by Mr. R. G. Oakley.

Calymmaderus bibliothecarum Poey, listed by Dr. Gundlach as a *Dorcatoma*, was characterized by him as "sumamente dañino, porque la larva perfora libros y destruye colecciones de historia natural, tanto zoológicas como botánicas," but this particular pest of books and natural history collections has not been reported from Puerto Rico since.

Catorama herbarium Gorham has been repeatedly identified by Mr. W. S. Fisher as a pest of the bindings of books in the San Juan region: a considerably larger beetle than *Lasioderma serricorne*, and sometimes accompanying it in destroying book bindings.

Catorama neltumae was recently described by Mr. W. S. Fisher as one of several "New Coleoptera from Puerto Rico" (Jour. Agr. Univ. P. R., **25** (4): 37–39. Río Piedras, April 7, 1942) from an abundance of material reared by Dr. Luis F. Martorell from the seed pods of mesquite or "bayahonda" (*Neltuma* or *Prosopis juliflora*), at Guánica. "This species is related to *Catorama herbarium* Gorham, but differs from that species in being uniformly black on the dorsal surface of the body, in having the pubescence on the pronotum and elytra finer and more silky, the punctures on the elytra irregularly distributed and not arranged in rows, the lateral striae extending only to the middle of the elytron, and the anterior tibia with only one longitudinal sulcus." It is 3.5 mm. long and 2.0 mm. wide.

Catorama insulicola Fisher (1936–240) is only 2.0 mm. long and half as wide, described from specimens intercepted on ucar (*Bucida buceras*) on the beach west of Ponce by Mr. R. G. Oakley.

The other non-economic species of Anobiid beetles intercepted by Mr. R. G. Oakley in the Ponce region which Mr. W. S. Fisher named and described (for three of which Dr. Blackwelder (1945-405 and 406) changes the gender of the specific name to the feminine, ending in **-a**) are:

Cryptorama densipunctatum Fisher (1936–240)

Protheca flavitarsis Fisher (1936–241)

Caenocara insulanum Fisher (1936–242)
Caenocara maculatum Fisher (1936–242)
Caenocara oakleyi Fisher (1936–241).

Aderidae (Euglenidae)

Mr. R. G. Oakley was even more industrious in collecting new species of Euglenids in the coffee groves, on orange trees and on various other hosts in the mountains north of Ponce. Of them, however, Mr. H. S. Barber, of the U. S. National Museum, to whom this material was assigned, has prepared no descriptions, but merely given subgeneric names such as *Ganascus*, *Pseudariotus*, *Sandytes*, *Hylophilus*, *Xylophilus* and *Zonantes*, the only specific determination being **Aderus guttatus** Champion, originally described from St. Vincent and Grenada. This beetle Mr. Oakley repeatedly collected on coffee in the Ponce region, on "moca" (*Andira jamaicensis*), on "roble de pantano" (*Quercus thompsonii*) and on "mato de playa" (*Guilandina crista*); and at Juana Díaz on guava (*Psidium guajava*) and orange.

Lymexylonidae: Ship-Timber Beetles

Atractocerus brasiliensis Laporte & Serville was first noted in Puerto Rico by Dr. Gundlach. "Solamente la he cogido cuando voló a la vela encendida en la casa de campo. Su vuelo es ruidoso o acompañado de un zumbido." It is a slender, elongate beetle, nearly an inch in length, with very small non-functional elytra standing erect on its back, and membranous hind wings reaching a little more than halfway to the apex of the abdomen. When the beetle is at rest, its hind wings are held upright like those of a butterfly. The characteristic noise which it makes in flight is doubtless due to the inadequacy of such short wings, but nevertheless, the insect persists in western Puerto Rico, and repeated collections have been made in the mountains by students of Dr. Danforth. The most recent collections were: at light at Lares in the fall of 1938 by Felipe Mora; at Las Bocas, Utuado in 1941, and at light in Ponce, 1946. Dr. Gundlach did not find it in Cuba, and it is not recorded from any other of the West Indies, but its range is from Mexico thru Central America and tropical South America to Argentina and Chile. Nothing is known of its life-history.

Nitidulidae: Sap-Feeding Beetles

With nothing comparable in the tropics to the abundant flow of sap of maple and other trees in the spring of the temperate zone, Nitidulid beetles occur mostly under the leaf-sheaths of sugar-cane, in rotten cane stalks, or those eaten by rats, as well as in decaying fruit of all kinds lying on the ground. They are small, flattened beetles, having wide, thin side-margins

of the thorax, and elytra often truncate long before the apex, leaving the end of the abdomen exposed.

Colopterus truncatus Randall, synonymous with the *Colastus infimus* which G. F. Erichson described from Puerto Rico (*in* E. F. Germar's "Versuch einer Systematischen Eintheilung der Nitidularien" (Zeit. für die Ent., **14:** 245. Berlin, 1843) has not since been collected here, but Mr. A. J. Mutchler identified specimens in the collection of Dr. Stuart T. Danforth as **Colopterus amputatus** Erichson.

Of **Conotelus fuscipennis** Erichson, now considered as only a variety of **Conotelus conicus** F., which is also separately listed by Dr. Blackwelder (1945–411) from Puerto Rico, Dr. Gundlach notes, "se le encuentra a menudo en el cáliz de las flores." Repeated collections have been made since in the more humid parts of the Island, on many kinds of flowers, such as rose, gardenia, kumquat, "roble" (*Tecoma pallida*) and "emajagua" (*Pariti tiliaceum*), of this exceptionally elongate, dark reddish-brown, spindle-shaped beetle, which has less than half the length of its tapering abdomen covered by its elytra.

Carpophilus dimidiatus F. has been found in abundance in flour and corn meal in Puerto Rico, in stored mahogany seed at Cayey, and Prof. J. A. Ramos reports it from Mona Island. The cosmopolitan variety **mutilatus** Erichson is listed from Vieques Island by Leng & Mutchler.

Carpophilus hemipterus L., as identified by Dr. E. A. Schwarz, was found in decaying cane seed at Río Piedras, only a single record, but actually this is a common insect in rotten seed or rat-eaten cane, which nobody since Mr. Thos. H. Jones has bothered to collect. It is black, with prominent large subtriangular yellow spots at the apex of the elytra.

Carpophilus (Urophorus) humeralis F., as identified by Dr. E. A. Chapin, was found on the ground at Arecibo under rotten fruits of "almendra" (*Terminalia catappa*) and of "jobo de la India" (*Spondias dulcis*).

Carpophilus tempestivus Erichson, as determined by Mr. W. S. Fisher, was found by Mr. R. G. Oakley on rotten oranges at Ponce. Undetermined species have been found in rotten maga pods at Vega Baja, and Dr. Wetmore reports finding these beetles eaten by the martin.

The yellow elytra of **Haptoncus luteolus** Erichson almost cover its short abdomen. Judging by the number of times it has been collected, it is by far the most abundant of Puerto Rican Nitidulids: under leaf-sheaths of sugar-cane, in cane chewed by rats, on tassels of corn, in rotten oranges, in rotten grapefruit, in rotten fruit of "jobo" (*Spondias mombin*), in rotten fruit of "jobo de la India" (*Spondias dulcis*), in rotten fruit of "níspero" (*Sapota achras*), in rotten fruits of "caimito" (*Chrysophyllum cainito*), in rotten fruits of "limón de Jerusalén" (*Triphasia trifolia*), and in rotten

pods of *Inga laurina*. Dr. Gundlach lists it as an *Epurma*, and Dr. Wetmore notes that it was eaten by a flycatcher. It has been repeatedly collected at light on Mona Island.

A small beetle identified as a species of **Epuraea** by Dr. A. E. Chapin has been collected at Mayagüez.

The cosmopolitan **Stelidota geminata** Say and the West Indian **Stelidota ruderata** Erichson are listed by Dr. Gundlach, and Dr. Wetmore found these beetles to have been eaten by the swift and the cliff swallow. Dr. Stuart T. Danforth collected them in large numbers from decaying citrus fruits in the Mayagüez region and in the mountains, at Las Marías and Maricao. Their distribution is general wherever citrus fruits are grown in Puerto Rico, altho the most eastern record is at Bayamón.

The very small dark brown **Stelidota strigosa** Gyllenhal, as determined by Dr. E. A. Chapin, was collected by Prof. J. A. Ramos on Mona Island.

Lobiopa insularis Castelnau, listed by Drs. Stahl and Gundlach as *Lobiopa decumana* Erichson, and thus identified for Dr. Danforth by Mr. A. J. Mutchler, is 6.0 mm. long, with the apex of its elytra rounded, lateral margins of prothorax and elytra thin and semitransparent yellowish. Mr. E. G. Smyth noted adults and larvae under rotten fruits of guava (*Psidium guajava*) on the ground at Río Piedras, and it has also been found under rotten fruit of "jobo" (*Spondias mombin*). Most records are from citrus fruits lying rotting on the ground, Dr. Stuart T. Danforth and students having made repeated collections in the Mayagüez region, at Las Marías and Maricao, and Mr. R. G. Oakley having intercepted it in the mountains back of Yauco, at Indiera. Adults may hide under the bark of trees, and have been attracted to light at Bayamón.

Dr. A. G. Böving identified as a species of **Glischrochilus** the beetles which Mr. R. G. Oakley found in rotten orange fruit at Ponce.

Cucujidae: Flat Bark Beetles

The early records of **Laemophloeus adustus** Leconte, listed by Dr. Gundlach, and of **L. bituberculatus** Reitter and **L. unicornis** Reitter, have not been confirmed by later collections, but unidentified species of this genus: minute, flattened, oblong reddish-brown beetles, were found under the bark of trees and in decaying wood by Dr. Donald De Leon when making his survey of forest insects of Puerto Rico in 1940.

The cosmopolitan flat grain beetle, **Laemophloeus minutus** Olivier, has been repeatedly found in wheat flour, in macaroni and in soup pastes, as well as in garden seeds and chocolate.

Silvanus bidentatus F., as identified by Mr. W. S. Fisher, was collected by Prof. J. A. Ramos at Mayagüez, Ponce and Humacao.

Herr Ferd. Nevermann of Costa Rica identified for Dr. Stuart T. Danforth some beetles collected at Mayagüez as **Silvanoprus scuticollis** Walker.

The foreign grain beetle, **Ahasverus advena** Waltl, was listed from Puerto Rico by Dr. Gundlach as a *Silvanus*, and by Riley & Howard (*in* Insect Life, **6**: 218. Washington, D. C., February 1894) as a *Cathartus*. It has since been intercepted in green lima beans and in dry pigeon peas at Bayamón, in the dry pods of *Inga laurina* at Juana Díaz, and most recently under the bark of a dead tree on Mona Island.

Ahasverus rectus Leconte, as identified by Mr. W. S. Fisher, was found in abundance on Mona Island by Prof. J. A. Ramos (1947–35), having previously been noted in pigeon peas at Bayamón.

The cosmopolitan **Cathartus quadricollis** Guérin-Méneville (= *C. cassiae* Reiche, under which name it was originally reported) was also collected in pigeon peas at Bayamón, and Prof. A. J. Ramos found them in abundance in tamarind pods at Faro de Cabo Rojo.

The saw-toothed grain beetle, **Oryzaephilus surinamensis** L., is a common pest of stored food products in Puerto Rico, having been found in corn, rice, dry dates, chocolate candy, raisins, walnuts, almonds, and most recently in babassú nuts, *Orbiginia speciosa*.

Monamus concinnulus Walker, as determined by Mr. W. S. Fisher, has been collected on bananas, grapefruit and pomarrosa (*Eugenia jambos*).

Nausibius clavicornis Kugelann, listed by Drs. Stahl and Gundlach as *N. dentatum* Marsham, has repeatedly been found since in brown sugar.

The German consul in Mayagüez, Herr Leopold Krug, who was instrumental in inducing Dr. Gundlach to visit Puerto Rico, was himself much interested in entomology, and in 1871 brought to Germany specimens of beetles which he had collected from the Mayagüez region. It was not until 1932, however, that Herr Ferd. Nevermann, of San José, Costa Rica, a specialist in the Cucujidae, described in his "Beitrag zur Kenntnis der Telephanus (Col. Cucujidae)" (Stettiner Ent. Zeitung, **93** (1): 1–35, pl. 2, Stettin, 1932) these specimens, collected sixty-one or more years previously, and untangled the nomenclature of the West Indian species. Later, he identified the light yellow, unmarked species common in Puerto Rico which hides during the daytime under the leaf-sheaths of sugar-cane. This is **Telephanus pallidus** Reitter, which he considered, if anything, to be a beneficial insect, as at night both larvae and adults feed on fungus spores. **Platamus** ? (**Telephanus**) **pallidulus** Chevrolat with which it has been confused, is quite a different species, most often found on withered banana leaves, but also present in grapefruit groves and on *Inga laurina*, or forest vegetation, and found in Cuba as well as in Puerto Rico.

Telephanus cubanus Nevermann (1932–28) was described from 41 speci-

mens in the Krug collection from Cuba and two from Puerto Rico, having five spots on the elytra forming an elongated pentagon.

Telephanus megacephalus Nevermann (1932–12) was described from three Puerto Rican specimens in the Krug collection, their most obvious character being a broad dark median band across the elytra.

Europs apicalis Reitter (in the older classification placed in the family Monotomidae), first determined from Puerto Rican material by Dr. E. A. Schwarz, was in pods of *Inga laurina* at Lares, but has since been found in the flowers of this coffee shade tree at Mayagüez and Adjuntas. It has been reared by Messrs. Richard Faxon and A. S. Mills from the seed pods of "maga" (*Montezuma speciosissima*) at Vega Alta.

The Cucujid Beetle, *Telephanus pallidus* Reitter, twelve times natural size. (Drawn by G. N. Wolcott.)

Europs maculata Grouvelle has been found in rotten papaya fruit at Arecibo, and under bark of almácigo at Guayama. Prof. J. A. Ramos found an undetermined species of *Europs* on Mona Island.

Smicrips palmicola LeConte, identified by Mr. W. S. Fisher as *S. hypocoproides* Reitter, was first found in Puerto Rico in rotten papaya fruit at Arecibo, but later collections have been made from the seed pods of mesquite or "bayahonda" (*Neltuma* or *Prosopis juliflora*).

Cryptophagidae: Silken Fungus Beetles

Hapalips filum Reitter are small beetles collected at Río Piedras and Ponce, identified by Mr. W. S. Fisher, which are now in the Mayagüez College of Agriculture collection.

The little beetles of the genus *Loberus*, superficially resembling some of the flea-beetles of the family Chrysomelidae, are represented in Puerto Rico by three or more species. **Loberus mutatus** Grouvelle, as identified by Mr. W. S. Fisher, has been intercepted in betel palm at Adjuntas, where also another species has been found on orange by Mr. R. G. Oakley.

The beetles found by Dr. Luis F. Martorell on watermelon vines on Mona Island, were identified by Mr. W. S. Fisher as a species of **Loberus** "not *mutatus* or *testaceus*," and later collections by Prof. J. A. Ramos (1947–36) sweeping vegetation on Sardinera and Uvero Beaches indicate that they are quite abundant on Mona.

Loberus testaceus Reitter is presumably the more common species, listed by Leng & Mutchler (1917–202) and identified for Dr. Stuart T. Danforth by Mr. A. J. Mutchler, the specimens from Boquerón. Without being specific, Dr. Wetmore notes these beetles eaten by the tody and the flycatcher, and they also form an item of food for the lizards *Anolis stratulus* and *Anolis cristatellus*. They have been found in the most diverse environments: in pink bollworm-injured cotton bolls at Pt. Cangrejos, in buds of "emajagua" (*Pariti tiliaceum*) at Arecibo, in pods of *Acacia farnesiana* at Boquerón, in dry pods of *Crotalaria incana* on the Mayagüez Playa, on leaves of *Inga laurina* and on tamarind flowers at Juana Díaz, and on the ground at Ponce, but it is quite possible that these do not all refer to the same species.

Phalacridae: Shining Flower Beetles

Phalacrus acutangulatus Chevrolat, previously known only from Peru, is the identification by Mr. A. J. Mutchler of some little oval shining black beetles found in cotton bolls at Pt. Cangrejos. Others, less highly polished but twice as large, at times abundant at light at San Juan and Río Piedras, have not been identified as to species. Those attracted to light on Mona Island have been identified as a species of **Acylomus** by Mr. W. S. Fisher.

Anthicidae: Ant-Like Flower Beetles

Of all the ant-like flower beetles, **Notoxus bipunctatus**, described from Puerto Rico by L. A. Auguste Chevrolat (Ann. Soc. Ent. France, (5), VII: ix. Paris, 1877) is immediately recognized by "the thoracic horn which extends in a sort of hood over the head," and the not so prominent posterior spot on each elytron. It was re-described by G. Quedenfeldt, the type from Puerto Rico, as *Notoxus krugii*, but Dr. Gundlach lists only **Notoxus dentipennis**, described by Chevrolat from Puerto Rico on the same page. The latter has not since been collected here, but the former has been taken at light at Pt. Cangrejos, Mayagüez and Ponce, and Mr. R. G. Oakley found it resting on ucar (*Bucida buceras*) at Ponce.

The beetles which Mr. R. G. Oakley found on the flowers of *Randia mitis* and other trees near Ponce were identified by Mr. H. S. Barber as a species of **Amblyderus**.

Anthicus floralis L., listed by Drs. Gundlach and Stahl, and by G. Quedenfeldt and Leng & Mutchler, was found by Dr. Wetmore to be an item in the food of the yellow-shouldered blackbird. These slender little reddish-brown beetles were found once in abundance in the central whorl of young shoots of sugar-cane at Arecibo, but we have no lead as to their role in a normal environment, for all other collections were at light: by Mr. R. G. Oakley at Ponce and by Prof. J. A. Ramos on Mona Island.

Dr. E. A. Schwarz tentatively identified as **Anthicus fulvipes** LaFerté two beetles which Mr. Thos. H. Jones found on the underside of aphid-infested okra leaves at Río Piedras, and this species has since been collected on flowers of flamboyán (*Delonix regia*) at Juana Díaz.

Anthicus vicinus was described by Marquis F. Thibauld de la Ferté-Sénectére on page 157 of his "Monographie de *Anthicus* et gen. voisins" (Paris, 1848) from "America borealis," but actually the type was from Puerto Rico. Herr G. Quedenfeldt (1186–122) re-described the same insect under the name of *fulvomicans*, and this was the name used by Drs. Gundlach and Stahl in their lists. It has since been found under fresh cow dung at Guánica by Mr. G. B. Merrill, as identified by Dr. E. A. Schwarz: a ferrugineous shining beetle, not pubescent, legs lighter in color, elytra densely punctate, dark at apex and about the middle. Apparently it is quite common in the xerophytic part of Puerto Rico, for numerous subsequent collections have been made under dung at Guánica and Ponce.

Lathridiidae: Minute Brown Scavenger Beetles

"**Eufallia unicostata** (Belon), a Fungus Eating Beetle new to Puerto Rico" (Jour. Ec. Ent., **33** (5): 810–11. Menasha, October 1940) was found by Dr. W. A. Hoffman in great abundance on the casein-covered walls of the School of Tropical Medicine at Puerta de Tierra, feeding on their fungus-discolored surfaces during wet weather.

Mr. W. S. Fisher identified as a species of **Melanophthalma** some beetles which Mr. R. G. Oakley collected on coffee in the mountains back of Ponce. This may be what Dr. Gundlach lists as "*Lathridus fasciatus* es su nombre en la colección del Museo de Berlín."

Coccinellidae: Ladybeetles

No injurious ladybeetle is known to occur in Puerto Rico, the Mexican bean beetle or bean ladybird, *Epilachna varvestis* Mulsant (= *E. corrupta* Mulsant) being a pest of beans only in Central America northward from Panama to Mexico and the southern United States. Of *Epilachna patricia*

Mulsant, recorded from St. Croix in the Virgin Islands, we have no record of its host plant, and it is not even listed by Harry A. Beatty in his "Fauna of St. Croix, V. I." (Jour. Agr. Univ. P. R., **28** (3–4): 103–185. Río Piedras, July 7, 1947).

Psorolyma maxillosa, in the "Descriptions de Varietes, Especes et Generes nouveaux appartenant a la Famille des Coccinellides" (Ann. & Mag. Nat. Hist., **9** (9): 349–360. London, April 1922) by A. Sicard was described as "ovalis, convexa nitida, coerulea; subtus piceo-brunnea; antennis, palpis, pedibusque pallide flavis. Mandibulis exsertis, oculis prominentibus distinctissimus. Long 2.5 mm." was from a type collected at Lares. This ladybeetle is common in coffee groves everywhere on the Island, but is possibly most abundant at the higher elevations, as at Indiera. Dr. Stuart T. Danforth's collection includes specimens from El Yunque, as well as from Cartagena Lagoon. The larva is grey with black spots, and often two or three occur on a single coffee leaf, without apparent source of animal food. Rarely are they found on coffee leaves infested with the aphid *Toxoptera aurantiae*, and we do not know what either larvae or adults eat. The beetles themselves are eaten by the lizard *Anolis gundlachi*. Other native ladybeetles are often snapped up by lizards, and indeed lizards prove to be one of the greatest hazards encountered in releasing introduced ladybeetles, appearing just as the shipping cage is opened and catching and swallowing the beetles, sent from abroad with such care and expense, before they can make even the first adjustment to their new environment.

Scymnodes lividigaster Mulsant is an introduced ladybeetle. Dr. Francis X. Williams, on p. 183 of his "Handbook of the Insects and other Invertebrates of Hawaiian Sugar Cane Fields" (Experiment Station of Hawaiian Sugar Planters' Assn., pp. 400, fig. 190, pl. 41. Honolulu, 1931) under the name *Platyomus lividigaster* (Muls.), describes it as "a hairy, shining black species, about 3.0 mm. long, with a large yellow spot occupying each side of the thorax above. The abdomen seen from beneath is reddish. It is well distributed but rather uncommon in the (Hawaiian) Islands, and is an importation by Koeble from Australia in 1894." A shipment of this beetle was made from Hawaii in 1938, of which a liberation was made at Lajas. "In general, the beetles did not appear to be particularly voracious on *Sipha flava*, but some feeding was observed in the laboratory."

Rodolia cardinalis Mulsant, the internationally famous Australian ladybeetle, was introduced into Puerto Rico from Florida in 1932 for the control of the cottony cushion scale. For a considerable number of years, a colony of living beetles was maintained in the laboratories of the Experiment Sta-

tion at Río Piedras, so that some might be immediately available to control any outbreak of this scale as soon as it was reported by the worried citrus grower. Presumably this was a service much appreciated, but in many cases the entomologist, bringing a supply of beetles or larvae for release where cottony cushion scale had never before been found, would discover the Australian ladybeetles already present by natural dispersion. Thus paralleling the spread of the scale, it became dispersed along the north coast of Puerto Rico and by 1940 had appeared in the mountains back of Mayagüez. In the region around San Juan, where it had once been temporarily very abundant, it could no longer be found, because other factors in the natural control of cottony cushion scale, added to its own efforts, had eliminated this, its only source of food.

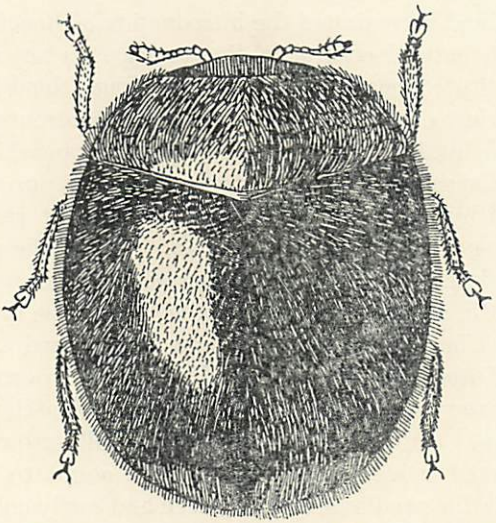
The planting of scale-infested beefwood (*Casuarina equisetifolia*) seedlings on Mona Island, brought from nurseries at Río Piedras, established the scale there, and necessitated the introduction of *Rodolia*. Some of the other factors in natural control in Puerto Rico do not exist or are less effective, thus "Introduced Ladybeetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, June 1944) find there a continuous supply of food sufficient "to maintain a reserve of ladybeetles from which they may be obtained in sufficient numbers to supply the very rare needs of Puerto Rico." Forced by stern necessity, *Rodolia* in recent years has survived feeding on the endemic *Icerya montserratensis*, as in the plaza of Manatí, and no sooner does an outbreak of *Icerya purchasi* get well started, as at Palo Seco in 1945, and at Bayamón in 1947, before the ladybeetles appear and proceed to eliminate it. The brilliant cardinal red and shining black of the adults of *Rodolia cardinalis* should make them conspicuous, but in reality they are very hard to find, and especially to catch in large numbers in a citrus grove. On casuarina, however, the fully-grown larvae migrate from scale-infested twigs to the needles when about to pupate, and the pupae far out on the needles are readily seen and easily collected, while one judges of the former abundance of the insect by noting the empty pupal skins still attached to the casuarina needles.

Stethorus punctum Le Conte, a continental North American species, was specifically re-determined by A. Sicard, confirming the tentative identification by Dr. E. A. Schwarz as "close to *punctum* Lec." of the minute little black ladybeetles which Mr. Thos. H. Jones had found on leaves of "bucare" (*Erythrina glauca*) infested with mealybugs, and Mr. E. G. Smyth had later noted on jobo and guava leaves infested with thrips and whiteflies. It has since been found in considerable abundance on the leaves of sugar-cane at Loíza heavily infested with the green red spider, *Tetranychus sacchari* McGregor, and may be a factor of considerable im-

portance in the control of this new minor pest. These beetles identified by Dr. E. A. Chapin only to genus, were found on Mona Island by Dr. Luis F. Martorell on leaves of castor bean infested by lace bugs.

Mr. S. M. Dohanian, when engaged in "The Importation of Coccinellid Enemies of Diaspine Scales into Puerto Rico" (Jour. Agr. Univ. P. R., **21** (2): 243–7. Río Piedras, July 1937) from Trinidad, included in his shipments of beetles collected on scale-infested coconut palms the comparatively rare **Scymnus aeneipennis** Sicard. Only seventeen of these beetles were actually sent to Puerto Rico, and none has been collected here since the release in January 1936.

Dr. Stanley E. Flanders has identified as **Scymnus flavifrons** Melsheimer some beetles accompanying *Saissetia nigra* material received from Puerto Rico.

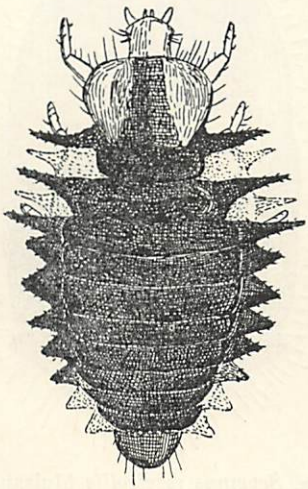


The Ladybeetle, *Scymnus roseicollis* Mulsant, thirty times natural size. (Drawn by G. N. Wolcott.)

Scymnus floralis F., listed by Dr. Gundlach from Puerto Rico, was collected by Prof. J. A. Ramos (1947–36) on Mona Island.

The little oval ladybeetle which the economic entomologist identifies by the orange prothorax and the orange apex of black elytra, earliest considered as a variety of *floralis*, but subsequently identified by Dr. E. A. Schwarz as **Scymnus roseicollis** Mulsant, is very common in Puerto Rico. Messrs. D. L. Van Dine and Thos. H. Jones were first to note its importance as a predator on the yellow aphid of sugar-cane, *Sipha flava* Forbes, and by the latter as attacking *Aphis setariae* Thos. on the same host. Mingled

with the aphids, one often notes the larvae of these ladybeetles, mostly black with retractile protuberances on the back. In reality, these almost omnipresent ladybeetles are not at all fussy about which particular kind of aphid serves as their food, and recent records are of their attacking *Aphis gossypii* Glover on cucumbers and okra, and resting on many other plants. With such characteristically marked elytra, their presence could be readily determined for Dr. Alex. Wetmore to report as items in the food of the tody, wood pewee, vireo, redstart, honey creeper and the yellow and parula warblers. Rather surprisingly, none was found in the stomachs of lizards. On Mona Island, Dr. Luis F. Martorell found them on the underside of castor bean leaves infested with lace bugs, and Prof. J. A. Ramos swept them from vegetation.



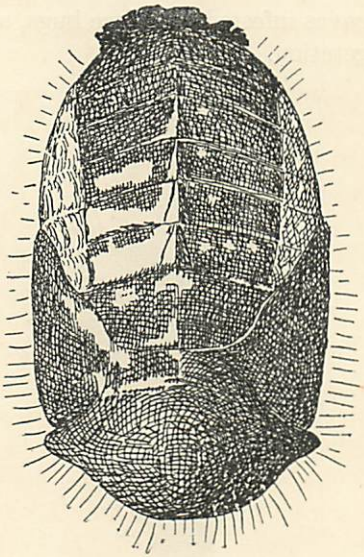
Larva of the Ladybeetle, *Scymnus roseicollis* Mulsant, forty times natural size. (Drawn by G. N. Wolcott.)

Scymnus phloeus Mulsant, formerly "frequently identified as *S. loewii* Muls., all records of *S. loewii* from the West Indies being certainly *phloeus*" according to Dr. E. A. Chapin, was listed from Puerto Rico by Dr. Gundlach. It has elytra laterally broadly margined with orange, the prothorax and median line of the elytra black. Judging by the records, it is not as common as *roseicollis*, but has almost identical habits. Dr. Wetmore found it in not a single bird stomach, nor was it found to have been eaten by lizards.

Scymnus thoracicus F., listed by Dr. Gundlach with **Scymnus ochroderus** Mulsant in synonymy, has not since been collected in Puerto Rico. "*Diomus thoracicus* Fabr., the type of the genus *Diomus*, and other species

including *D. roseicollis* Muls. of the West Indies, possess antennae of eleven segments and tarsi of four segments," according to Dr. E. A. Chapin (1933–95), *Diomus* being a subgenus of *Scymnus* as listed by Dr. R. E. Blackwelder (1945–444), and these two species distinct.

When most intensive studies were being made of the natural enemies of the cottony cushion scale, *Icerya purchasi* Maskell, after its initial occurrence and rapid spread in Puerto Rico, other ladybeetle larvae were noted, not associated with those of *Rodolia cardinalis*, on the exposed beach at Dorado where the introduced Australian ladybeetles failed to thrive.



Pupa of the Ladybeetle, *Scymnus roseicollis* Mulsant, forty times natural size. (Drawn by G. N. Wolcott.)

They pupated when much smaller than the introduced *Rodolia*, and emerged a few days later as light red beetles with two large black spots on each elytron. A technical "Description of the Larva of **Decadiomus pictus** Chapin (Scymnini, Coccinellidae)" by Dr. Adam G. Böving (Proc. Biologial Soc., Washington, **46:** 101–4, pl. 1. Washington, D. C., April 27, 1933) complements the naming and description of the adult of this new ladybeetle by Dr. E. A. Chapin in "A New Genus of West Indian Coccinellidae (Coleoptera)" in the immediately preceding pages (95–99, pl. 1) of the same journal. This endemic ladybeetle must have been predaceous on some other insect before the cottony cushion scale occurred in Puerto Rico, and the subsequent extreme scarcity of its adopted host is possibly one reason why it has since been found feeding on scale insects

of coconut palm at San Juan, and intercepted at Ponce and Yauco by Mr. R. G. Oakley, not associated with any host. *Decadiomus pictus* is "flesh-pink to red, ornamented with piceous to black markings,—length 1.6 mm."

Decadiomus tricuspis Chapin (1933–98) is "very pale stramineous (almost white)—length 1.0 mm.," the type collected on papaya at Río Piedras by Dr. H. L. Dozier, who characterized the larvae, feeding on whiteflies, *Metaleurodicus variabilis*, and the pupae as being "soiled white, without markings, and covered with fine hairs."

"The mealybug destroyer, **Cryptolaemus montrouzieri** Mulsant," according to Dr. E. O. Essig on p. 415 of his "Insects of Western North America," "is 3.0 to 3.5 mm. long, shining black, with the head, prothorax, tips of the elytra, and abdomen reddish. The minute oval eggs are yellow and are laid singly among the hosts. The larvae are yellow and entirely covered with long white waxy filaments. When mature they are 7.0 to 10.0 mm. long, and are often mistaken for huge mealybugs. The species was introduced from Australia into California in 1892 by Albert Koeble and has proven to be one of the most proficient enemies of the many kinds of mealybugs in California where it is firmly established." It was the first ladybeetle to be introduced and to become established in Puerto Rico. Mr. D. L. Van Dine, Entomologist of the Sugar Producers' Experiment Station at Río Piedras, had distributed it by 1911 thruout the cane districts of the Island, and had recovered it in the field. When reared in captivity, furnished mealybugs from sugar-cane for food, it accepts them without question and appears to thrive on a diet composed exclusively of this one kind of mealybug. When released, however, it finds these mealybugs protected by cane leaf-sheaths much too difficult to reach, by comparison with the numerous exposed mealybugs and soft scale insects present in Puerto Rico. Indeed, the first authentic record of finding *Cryptolaemus montrouzieri* living in a cane field was by Dr. H. L. Dozier more than a dozen years later, feeding not on the protected mealybugs, but on *Pulvinaria iceryi* Guérin-Méneville, a soft scale insect normally occurring on sugar-cane, but in only this one case in sufficient abundance to attract these imported ladybeetles into a cane field. Another soft scale, *Pulvinaria psidii* Maskell, is often common on "palo de muñeca" (*Rauwolfia nitida*), and when its leaves are noted blackened by sooty mold from the scale, one can usually find some of these ladybeetles present. On trees of "jobo" (*Spondias mombin*), each dry autumn at Río Piedras *Pulvinaria psidii* formerly became so abundant as to cause an early shedding of the leaves, and great clusters of the scale and their waxy secretions accumulated on the underside of each leafless twig and branch. One never sees such mass infestations since the introduction of *Cryptolaemus*. The introduced scales *Icerya purchasi* Maskell and *Coccus viridis* Green are also eaten to some

extent, and the common exposed mealybugs *Pseudococcus citri* Risso, *Pseudococcus adonidum* L., and *Pseudococcus nipae* Maskell.

Scymnillus nunenmacheri Sicard (1922–355) is the only endemic scale-feeding ladybeetle normally to be found in Puerto Rican citrus groves. It is iridescent blue-black, 1.2 to 1.5 mm. long, and feeds on other diaspine scale insects, as on coconut palms and cycads, Dr. Luis F. Martorell finding it even attacking the mealybug *Pseudococcus nipae* Maskell on leaves of "anacagüitas" (*Sterculia apetala*) at Ponce. It is rarely sufficiently abundant in citrus groves or coconut groves to be much of a factor in the natural control of scale insects.

Scymnillus variipennis Sicard (1922–354), a small light brown ladybeetle, present with its bluish-grey larvae and reddish-brown puparia in great abundance on the leaves of coconut palm infested with *Aspidiotus destructor* Signoret at Río Piedras, has since been found in comparable abundance on coconut palms at Ponce. Dr. R. T. Cotton observed them feeding on mealybugs in grapefruit groves, and collected them on guava leaves infested with mealybugs and whiteflies, and on jobo leaves infested with thrips. Dr. Alex Wetmore reported species of *Scymnillus*, presumably this or the preceding, had been eaten by the tody, wood pewee, vireo and various warblers, and by the honey creeper or "reinita". None of these minute ladybeetles was found in the stomachs of the lizards examined, but it may be presumed that they are eaten by lizards when an opportunity is presented.

Of **Zilus cyanescens,** described by A. Sicard as a *Scymnillodes* from Jamaican specimens, characterized as "subrotundus, convexus, nitidus, supra cyaneous; antennis flavis, palpis rufis; subtus nigro-brunneus; pedibus rufis", he subsequently differentiated the Puerto Rican variety **violaceous** with "elytris violaceo-micantibus, prothorace angustiore". The types of this variety were collected from coconut palm infested with *Aspidiotus destructor* Signoret, but subsequently Dr. Richard T. Cotton noted them in considerable abundance feeding on *Asterolecanium bambusae* Boisduval on bamboo at Vega Baja, apparently the only record of an endemic ladybeetle attacking this scale.

Dr. E. A. Chapin, in describing "New Coccinellidae from the West Indies" (Jour. Washington Academy of Sciences, **20** (20): 488–495. Washington, D. C., December 4, 1930) presents the new name **Scymnillodes caseyi** for Casey's *Delphastus violaceus*, of which he noted two specimens collected "from Maricao, Porto Rico, July 2, 1917 by Harold Morrison".

Zilus gilvifrons, the types collected at Maricao by Dr. Harold Morrison, was described as a *Scymnillodes* by Dr. E. A. Chapin (1930–493). It has "metallic violaceous elytra", and is "easily recognizable by the brilliant

yellow pubescence on head and pronotum, length 1.5 mm." It has been repeatedly collected since in coffee groves in the mountains, and in orange groves, but without definite record as to the insects on which it was feeding.

A shipment containing 146 live **Hyperaspis billoti** Mulsant, collected in Trinidad by Dr. K. A. Bartlett, was opened in Río Piedras on February 9th, 1939, and the ladybeetles released on a small wild orange tree heavily infested with *Selenaspidus articulatus* Morgan. Most of the ladybeetles promptly took flight, and of those which remained in the scale-infested tree, several disappeared inside a crested lizard which had suddenly become interested when these little beetles began to emerge from the package. The scales shortly afterwards disappeared from the orange tree, but whether this was due to the introduced ladybeetles could not be determined by repeated observations. None of the descendants of these beetles has since been collected in Puerto Rico.

In contrast to the introduced ladybeetles from Australia that prefer unprotected and exposed mealybugs, rather than those hidden under the leaf-sheaths of sugar-cane, **Hyperaspis trilineata** Mulsant of Barbados is normally to be found only feeding on those of sugar-cane. This is quite a large ladybeetle, 4.0 mm. long, mostly dull orange in color, with the median margin and an elongate stripe on the elytra black, forming the "three lines" of the specific name. In life, both larvae and adults are usually whitened with the wax of their host, with which they are so closely associated under the cane leaf-sheaths. Repeated sendings of this beetle were made by Mr. R. W. E. Tucker in 1932 to 1935, and releases made in all parts of Puerto Rico. No recoveries have been made to date, and it seems doubtful if this ladybeetle became established in Puerto Rico.

Hyperaspis connectens Thunberg has two large dull orange spots on each black elytron connected to form a large "C", but the smaller and often more yellowish spots of **Hyperaspis festiva** Mulsant, aberation **apicalis** Weise, are joined, if at all, only narrowly on the lateral margin. Both species are listed by Dr. Gundlach. Dr. Wetmore found remains of the latter in the stomach contents of the martinique, the parula warbler, and the martin, while Dr. Danforth found that it had been eaten by the golden warbler. In every case where these ladybeetles are found associated with a host, this has invariably been aphids; most often *Sipha flava* Forbes on sugar-cane, but also *Aphis gossypii* Glover on cotton. Often they are found singly on plants not infested with aphids, but they are so constantly associated with the yellow aphid of sugar-cane, and in such numbers, that one may consider them as a major factor in its natural control.

Cryptognatha nodiceps Marshall and **Cryptognatha simillima** Sicard were found in abundance in Trinidad on coconut palms by Mr. S. M. Dohanian, who sent 646 of the former and 94 of the latter to Puerto Rico for release

in coconut groves. This was in sufficient numbers so that the former, at least, became firmly established here.

Delphastus nebulosus, described by Dr. E. A. Chapin as one of the "New Genera and Species of Ladybeetles related to *Serangium* Blackburn (Coleoptera: Coccinellidae)" (Journal Washington Academy of Sciences, **30** (16): 263–272, fig. 24, ref. 13. Washington, D. C., June 15, 1940), is characterized by being "pale yellow-brown, legs whitish, elytra each with a single basal castaneous spot of indefinite extent, length 1.0 mm., width 0.8 mm.". It was described from a type intercepted by Mr. R. G. Oakley at Villalba, but collections had been made long previously by Mr. Thos. H. Jones at Río Piedras, and at Martin Peña on bushes of guava (*Psidium guajava*) heavily infested with whiteflies. Large numbers of adults and larvae were found on a papaya tree at Isabela heavily infested with white scale in April 1939, and collections have also been made at Barceloneta and Ponce.

Pentilia insidiosa Mulsant (= *P. castanea* Mulsant) was first collected for importation into Puerto Rico by Mr. S. M. Dohanian on coconut palms in Trinidad, but later shipments were made by Dr. K. A. Bartlett, as related in his "A Search in Guianas and Trinidad for Predatory Beetles on the Bamboo Scales" (Jour. Agr. Univ. P. R., **22** (4): 493–5. Río Piedras, March 23, 1939), and were reared in the laboratory at Mayagüez, releases being made only of reared material. In succeeding years, these light to dark chestnut brown beetles were reported as being "well distributed" and "notably active" in the Mayagüez region. Dr. Bartlett at the same time sent a species of *Pentilia* that was dark brown in color, with red spots on the elytra, and another *Pentilia* which was "a solid dark brown".

Pentilia egena Mulsant, a shining hemispherical black ladybeetle of Brasil, was collected for shipment to Puerto Rico by Dr. K. A. Bartlett, and later shipments were made by Dr. Felisberto C. de Camargo from Campinas, Sao Paulo. A very similar ladybeetle, but blue-black in color, found several years before the introductions at Mayagüez, in considerable numbers in the stomachs of crested lizards from the Condado beach, was identified by Dr. E. A. Chapin as a species of **Pentilia.**

The densely pubescent black ladybeetles with a large circular spot of shining black on each elytron, tentatively identified by Mr. Harold E. Box as **Azya orbigera** Mulsant, which he collected in Venezuela in 1926 feeding on the hemispherical scale, were sent by him to Puerto Rico as pupae. Thirty beetles emerging were released in the Condado, and an equal number placed outdoors at Río Piedras in a wire cage over a coffee tree infested with *Saissetia hemispherica.* After the second generation of beetles had begun to develop in captivity, the wire cage was removed. In 1940, Dr. K. A. Bartlett reported the introduction of this or a similar

species, collected in Brasil, of which releases were made in the environs of Mayagüez.

The elytra of **Azya trinitatis** Marshall are blue-black in color, evenly but much less densely pubescent than the prothorax. Mr. S. M. Dohanian collected this ladybeetle in Trinidad, feeding on the scales on coconut palm. Only 11 beetles were sent to Puerto Rico by him, but additional shipments were subsequently made and by 1938 the species was considered "well established" in the environs of Mayagüez. Prof. J. A. Ramos has since collected it feeding on coconut scales at Guánica and Ponce.

Ladoria desarmata Mulsant was sent from Brasil by Dr. K. A. Bartlett, but only seven beetles arrived in Puerto Rico.

Each elytron of the black **Chilocorus cacti** L. bears a large dark crimson spot, and the comparable continental *Chilocorus bivulnerus* Mulsant is called the twice-stabbed ladybeetle. Subsequent to the initial introduction of a few of these beetles from Texas, a large number was sent from Cuba, and reared at Mayagüez on white scales on papaya trees outdoors under screen cages. The large beetles are so conspicuous as to fall an easy prey to lizards, as on the naked trunk of a papaya they have no protection. It would appear, however, if even one female beetle escapes and lays her eggs, the gregarious larvae will soon clear a large area on the papaya trunk of all large live scales, and succeeding generations may largely eliminate the scale from that and adjacent trees, and may entirely clear a grove in time. These ladybeetles were originally introduced into Puerto Rico in the expectation that they would feed on the scales on bamboo, but they by no means confine their attention to one species of scale insect. They eat both the white and the grey scales on papaya, and the scales on coconut palms, besides numerous other scales on wild hosts. It has been noted in citrus groves that they appear to have cleaned some trees of all live scale, and they might have been an important factor in the natural control of scale insects of grapefruit, if their introduction had occurred earlier when the production of grapefruit was a thriving industry. Indeed, on the ornamental shrub *Acalypha wilkesiana*, where the beetles are well protected by the dense reddish foliage from being easily caught by lizards, they may be not only commercially but actually 100% successful in destroying all scale insects. While numerous releases of these beetles have been made in different parts of Puerto Rico, they appear to have widely dispersed on their own initiative, and the finding of these "Introduced Ladybeetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, August 1944) is ample proof of the vigor with which they invade new environments. In December 1947, many were noted feeding on coconut scales at La Romana, Dominican Republic. At Kenscoff, Haiti, they are apparently responsible for the entire elimination of the West Indian peach

scale from peach trees, the earliest record of this ladybeetle from Haiti being from Jérémie in 1945.

The sharply differentiated, prominent yellowish lateral lobes of the dark blue prothorax and the shining dark blue elytra will identify **Curinus coeruleus** Mulsant, introduced into Puerto Rico from Martinique, French West Indies. It became established at Mayagüez and Bayamón by 1939, and has since been collected by Prof. J. A. Ramos at Río Piedras and at San Germán.

Egius platycephalus Mulsant, with shining yellow pronotum but dull black elytra so greatly produced laterally as to make the beetle appear broader than it is long, was introduced from Cuba. It has become established in the environs of Mayagüez, whence large-scale releases have been made in scale-infested bamboo at Loíza and Maunabo.

With the co-operation of Dr. Felisberto C. de Camargo at Campinas, Sao Paulo, Dr. K. A. Bartlett sent or had sent to Puerto Rico large numbers of **Exochomus orbiculus** Weise, and later received many **Exochomus jourdani** Mulsant from Brasil. Releases of both beetles were made at Mayagüez.

Cladis nitidula F. is a large, bright yellow ladybeetle, with head, eyes, middle of pronotum and elytra bright iridescent green. The larvae are white, yellow and black, spiny; the puparia orange-yellow marked with black, occurring singly or in clusters of three or four. Introductions of this ladybeetle were made from Trinidad and Martinique, and releases made at Mayagüez, in the expectation that they would be predaceous on bamboo scales. In April 1945, Mr. Francisco Seín found larvae and adults predaceous on *Orthezia praelonga* Douglas on bougainvillea vine at Río Piedras, and subsequently they were noted on gardenia bushes feeding on *Coccus viridis* Green and *Protopulvinaria longivalvulata* Green, eventually entirely freeing the bushes of these scales.

Dr. Francis X. Williams (1931–182) states that "if we first consider those ladybeetles that feed principally on plant-lice or aphids, we must place **Coleophora inaequalis** (Fabr.), an introduction from Australia in 1894, well at the head of the list, both as regards efficiency and abundance. It is a rather large, polished orange-red species, usually with heavy black markings, that measures about 5 millimeters or a fifth of an inch long. In Australia, it varies more in color and intensity of markings, one form being nearly all black". Many in Puerto Rico, descended from those brought from Hawaii, are mostly orange-red above with only the posterior half of the pronotum irregularly margined with black. "It is possible to rear a brood in 2 weeks' time, but the adults do not lay eggs until several days after hatching. Both larvae and adults devour aphids in great quantity, and they feed also upon the young of the sugarcane leafhopper, particularly

when the pest is numerous, and on other small creatures. *Coleophora*, however, is by no means confined to the agricultural districts, for we often find it on forest trees in the mountains, and in city gardens feeding on aphids on hibiscus". In 1938, a shipment of this Australian ladybeetle was received from Hawaii, and released in cane fields near Mayagüez, Cabo Rojo and Villalba, in the expectation that it would feed on *Sipha flava* Forbes, the yellow aphid of sugar-cane. Laboratory rearing and field releases were continued for some time, presumably firmly establishing it in Puerto Rico.

The most abundant of all the ladybeetles at present to be found in Puerto Rico is unquestionably the hemispherical **Cycloneda sanguinea** L., a medium-sized black species with the lateral margins of the pronotum and a spot on each side white, the entire elytra shining orange-red. Presumably it is endemic, Dr. Gundlach listing it as a *Neda*, and Dr. Stahl as a *Daulis*. Dr. Alex. Wetmore found that it had been eaten by the ani, tody, petchary, wood pewee, elainea, cliff swallow and a vireo. It was found to form part of the food of *Anolis gundlachi*, and presumably is also eaten by other lizards. It has most often been noted as predaceous on the yellow aphid of sugar-cane, *Sipha flava* Forbes, but it will eat any species of aphid on any host, anywhere in Puerto Rico. Dr. M. D. Leonard noted that it even feeds on the cottony cushion scale, and this observation has recently been confirmed by Mr. Francisco Seín. It occurs on Mona Island and in most of the West Indies, and in most South American countries, but has not been recorded from Vieques, Culebra and Desecheo. While scarcity of food in some cases may be the limiting factor in preventing it from becoming even more abundant, the Braconid wasp parasite, *Homalotylus terminalis* Say, which attacks the larva and causes the pupa to mummify, is the most obvious cause of its scarcity when food is present in abundance.

Procula ferruginea Olivier, previously assigned at various times in the genera *Neda*, *Cycloneda* and *Daulis*, is an even larger hemispherical endemic ladybeetle, entirely chestnut brown in color, except for black eyes. It is listed by Dr. Gundlach, and all earlier records are from coffee groves. Its presence in the mountains, however, is largely incidental, for it feeds largely or entirely on Psylliids, and in coffee groves it finds a great abundance of these on the tender shoots of the coffee shade tree *Inga vera*. In the forest of logwood, *Haematoxylon campechianum*, in the Guánica Insular Forest between Hda. María Antonia and the coast at Ballena, these beetles were noted exceptionally abundant, and sure enough, enormous numbers of the logwood Psylliid, *Heteropsylla fusca* Crawford, were present on the tender shoots of the trees.

Superficially resembling *Cycloneda sanguinea* in coloration, but longer

and narrower is **Coleomegilla innotata** Mulsant, listed by Drs. Stahl and Gundlach and in all the earlier local economic literature as a *Megilla*. It is not very abundant, and really is only a minor factor in the control of aphids, less often found on those of sugar-cane than on those of honey-dew melons, okra, beans and other garden vegetables. Mr. E. G. Smyth noted this beetle so often on hosts lacking aphids that he concluded they might also feed on pollen. Prof. J. A. Ramos states that these beetles are sometimes rather abundant on the aquatic vegetation of Cartagena and Guánica Lagoons, but possibly these plants are infested with *Rhopalosiphum nymphae* L., the waterlily aphid. It has plain, shining orange-red elytra, and is recorded only from Puerto Rico. The internationally common *Coleomegilla maculata* DeGeer has more pinkish elytra, spotted with black. It is not listed from Puerto Rico, but a live individual has been collected at the airport at Arecibo during wartime, to which it may accidentally have been carried in a plane from Cuba or continental United States.

Mr. R. H. Van Zwaluwenburg lists *Hippodamia convergens* Guérin-Méneville as predaceous on aphids at Mayagüez, where it had been introduced from California by Dr. C. W. Hooker in 1912, but it has not since been collected.

Dr. Felisberto C. de Camargo, Director of the Instituto Agronomico do Norte, at Belém do Pará, Brasil, when formerly at Campinas, Sao Paulo, made a special study of the Coccinellid genus *Psyllobora*, and has in preparation a monograph on the genus, which he is now much too busy to bring to completion. He claims that these little beetles feed only on the spores of rusts, and that one should search for them on plants the leaves or stems of which have been reddened by the breaking open of rust pustules. The little hemispherical yellowish **Psyllobora nana** Mulsant, with large black spots, has been taken at many points in Puerto Rico, resting on a great variety of hosts, but no collector has noted whether any of these showed rust spots.

Psyllobora lineola F. has much smaller black spots, and is a brighter yellow. Dr. Gundlach lists it, and subsequent collections have been made at Boquerón, Ponce, Guayama and on the Isle of the Caves in Laguna San José, between Pt. Cangrejos and Río Piedras. Prof. J. A. Ramos found both species quite abundant on Mona Island, on weeds, and the former also attracted to light.

Erotylidae: Pleasing Fungus Beetles

Under the light of the lighthouse at East Cape on Mona Island, on April 1, 1940, Dr. Luis F. Martorell collected four oval, dull black beetles, 5.0 mm. long, concerning which Mr. W. S. Fisher states that they belonged either to *Mycotretus* or *Tritoma*.

Some Erotylid beetles collected at Mayagüez by Prof. J. A. Ramos have been identified by Mr. W. S. Fisher as probably a species of *Hypodacne*.

Mycetophagidae: Hairy Fungus Beetles

Litargus balteatus LeConte, as identified by Mr. W. S. Fisher, was intercepted by Mr. R. G. Oakley on flowers of an undetermined plant near Ponce, and at Utuado what may be this species. Dr. Wetmore found a species of *Litargus* eaten by the northern parula warbler.

Typhaea semirufa Chevrolat is listed from Puerto Rico by Dr. Gundlach, but it has not since been collected here.

Typhaea stercorea L., (= *T. fumata* L.), a "narrowly oblong-oval, slightly convex, dull reddish brown beetle", 3.0 mm. long, "distributed by commerce to all parts of the world" according to Blatchley, in stored flour or grain, has been found in Puerto Rico in dry crotalaria pods at Pueblo Viejo, at light in Ponce, and Prof. J. A. Ramos reports collection on Mona Island.

Colydidae: Cylindrical Bark Beetles

Aulonium bidentatum F., listed by Dr. Gundlach, was found by Dr. Wetmore to have been eaten by a black and white warbler, which, in its habits of search for food resembles the nuthatches. He found that the black and white warbler had also eaten **Asynchita granulata** Say, listed by him as an *Endeitoma*, and later called a *Synchita:* "oblong, parallel, moderately convex; uniformly dull reddish brown, subopaque; elytra coarsely granulate, length 4.0 mm." and in life covered with a lavender bloom that is very noticeable on the insect in the field but seems to have disappeared completely from museum specimens. It is common under the bark of trees in the dryer portions of the Island, where it has been repeatedly collected, and has also been found on El Yunque, and at Aibonito in a tree fungus.

Cryptozoon civile and **Cryptozoon nitidicolle** were described from Puerto Rican type material by L. W. Schaufuss in his "Coleopteres aveugles de la Famille des Colydidae" (Ann. Soc. Ent. France, Ser. 6, **2:** 46–48. Paris, 1882), but neither has since been collected here or elsewhere.

Bitoma undata Guérin-Méneville was the determination of Mr. A. J. Mutchler for Dr. Stuart T. Danforth of a beetle which he had found under the bark of decaying trees of "almácigo" (*Bursera simaruba*) at Joyuda. It has since been collected under the bark of an unspecified tree at Añasco, but no subsequent collections have been made of the **Bitoma trifasciata** Moritz listed by Leng & Mutchler as a *Ditoma*, nor of **Eulachus semifuliginosus** Chevrolat and **Neotrichus tuberculatus** Chevrolat, also listed by them.

Lobogestoria gibbicollis Reitter, as determined by Mr. W. S. Fisher, has been intercepted in rotten wood at Adjuntas, and in rotten wood in the mountains north of Ponce by Mr. R. G. Oakley.

Pycnomerus exaratus Chevrolat is recorded from Puerto Rico by G. C. Champion in his "List of the Clavicorn Coleoptera of St. Vincent, Grenada and the Grenadines" (Trans. Ent. Soc. London for 1898, p. 401).

Pycnomerus biimpressus Reitter was the identification given by Mr. W. S. Fisher of some beetles collected under a dead tree at Matrullas Dam by Mr. R. G. Oakley, and at Mayagüez by Prof. J. A. Ramos.

Penthelispa aequicollis was described by Edm. Reitter as one of the "Neue Colydidae des Berliner Museums" (Deutsche Ent. Zeitschrift, **22** (1): 123. Berlin, 1878) from material collected in Puerto Rico, and it has been repeatedly intercepted since from decaying wood and tree fern fronds, *Cyathea arborea*, in the mountains.

One or more species of **Ethelema** occur in Puerto Rico, living on leaves of pomarrosa and coffee shade trees, or on dead leaves and debris on the ground at the higher elevations.

Bothrideres dentata Chevrolat, as identified by Mr. W. S. Fisher, was found under bark of beefwood (*Casuarina equisetifolia*) at Guánica, and under bark of dead tree in Guánica Forest by Prof. J. A. Ramos.

Philothermus puberulus, described by Dr. E. A. Schwarz (1878–361) from Florida, has been collected on El Yunque, and on decaying wood at Añasco.

Euxestus erithacus Chevrolat, first recorded from Puerto Rico by Albert Fauvel in his "Notes Synonymiques" (Rev. d'Entomologie, **14:** 106. Paris, 1895), considered "probably not more than a variety of *E. parki* Wollaston" by Leng & Mutchler, is indeed synonymous with *Olibrus parki*. Under this should presumably be grouped the records of species of *Olibrus* found by Dr. Alex. Wetmore to have been eaten by the northern parula warbler, and noted by Dr. M. D. Leonard as commonly found breeding in dry pods of pigeon peas at Río Piedras during July and August. These beetles were also repeatedly intercepted by Mr. R. G. Oakley: on fungus on a tree and on *Inga vera* at Aibonito; on orange leaves and on flowers of *Inga laurina* at Adjuntas; on leaves of "moca" (*Andira jamaicensis*) at Ponce, and on wild morning-glory at Juana Díaz.

Mordellidae: Tumbling Flower Beetles

The Mordellid beetles are small and wedge-shaped, characterized by Mr. W. S. Blatchley as "having the body arched, the head bent downward and the abdomen usually prolonged into a style or pointed process". "The name *Mordella*, that of the typical genus, is from the Latin *mordere*, or 'bite'." Herr G. Quedenfeldt, working on the material submitted by

Dr. Gundlach, described in "Neue und selterne Kafer von Portorico" (Berliner Entomologische Zeitschrift, **30** (1): 119–128. Berlin, 1886) four new species from Puerto Rico and identified two others. It remained for Mr. Eugene Ray, however, in his "Synopsis of the Puerto Rican Beetles of the Genus *Mordellistena*, with Descriptions of New Species" (Proc. U. S. National Museum, **84** (3020): 389–399, fig. 1, ref. 5. Washington, D. C. 1937) to describe ten additional endemic species, collected in almost equal numbers by Mr. R. G. Oakley, and by Mr. C. M. Matos, formerly one of the students of Dr. Stuart T. Danforth at Mayagüez, and now and for many years past, Agricultural Agent at Comerío.

Mordella basifulva Quedenfeldt and **Mordella leucocephala** Quedenfeldt have not been found in Puerto Rico since Dr. Gundlach collected the types here.

Mordella scutellaris F., first reported from Puerto Rico by Dr. Gundlach, has been repeatedly collected since: on milkweed flowers at Bayamón, on flowers of "margarita" (*Bidens pilosa*), "cundeamor" (*Momordica charantia*) and other plants at Arecibo; of "zarza" (*Senegalia westiana*) at Ponce. Others of this genus, not identified as to species, have been collected on coffee and "jagüey" (*Ficus laevigata*).

Mordellistena annuliventris Quedenfeldt, according to Ray (1937–390), is characterized with the "ventral surface bicolorous", and was most recently collected at Aibonito by Mr. R. G. Oakley, by Prof. J. A. Ramos at Mayagüez and Ponce, and also on Mona Island.

The type of **Mordellistena angustiformis** Ray (1937–390) was intercepted by Mr. R. G. Oakley at Indiera, in the mountains above Yauco, and Mr. C. M. Matos found others at Adjuntas.

The type of **Mordellistena barberi** Ray (1937–395) was intercepted by Mr. R. G. Oakley at Ponce on "moca" (*Andira jamaicensis*), others on coffee at Juana Díaz.

The type of **Mordellistena danforthi** Ray (1937–392) was from Villalba, collected by Mr. C. M. Matos.

The type of **Mordellistena ephippium** Ray (1937–398) was from Aibonito, other from Ponce, intercepted by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*).

Mordellistena ferruginea F. is listed as a continental species, but the only assured records are from St. Thomas and Puerto Rico. The early record by Dr. Gundlach has been confirmed by numerous later collections: on banana leaf at Ponce, on mamey leaf at Barceloneta, on *Inga laurina* at Juana Díaz, and possibly to it also should be assigned Dr. Wetmore's records (as sp.) of being eaten by the wood pewee, the redstart and the yellow warbler.

The type of **Mordellistena humeralis** Ray (1937–393), collected by

Mr. C. M. Matos, was from Villalba; that of **Mordellistena leai** Ray (1937–396) was collected by the grapefruit grower Capt. Lesne in his grove at Bayamón, other from Maricao.

Maricao is also the type locality for **Mordellistena lucidovirga** Ray (1937–398), collected by Dr. Harold Morrison, and others have since been found by Prof. J. A. Ramos at Mayagüez.

The type of **Mordellistena lineata** Ray (1937–395) was collected at Guánica by Mr. C. M. Matos, and this species has since been found on Mona Island by Prof. J. A. Ramos.

The presence in Puerto Rico of **Mordellistena marginicollis,** described from Brasil by F. W. Mäklin as one of his "Neue Mordelliden" (Acta. Soc. Sci. Fennicae, **10:** 561–595. 1875), is implied by inclusion in Ray's paper, where he differentiates it as having "elytra more than three times as long as broad". No recent collection has been made here.

Mordellistena signaticollis, described from Puerto Rico by Herr Quedenfeldt as a *Mordella,* is characterized, according to Ray, in possessing "basitarsus with two oblique ridges". No specimen has been collected since Dr. Gundlach's of the type.

The type of **Mordellistena varietas** Ray (1937–391) is from Adjuntas, others from Villalba and Maricao; that or **Mordellistena y-nigrum** Ray (1937–397) was intercepted by Mr. R. G. Oakley on *Inga laurina* at Juana Díaz.

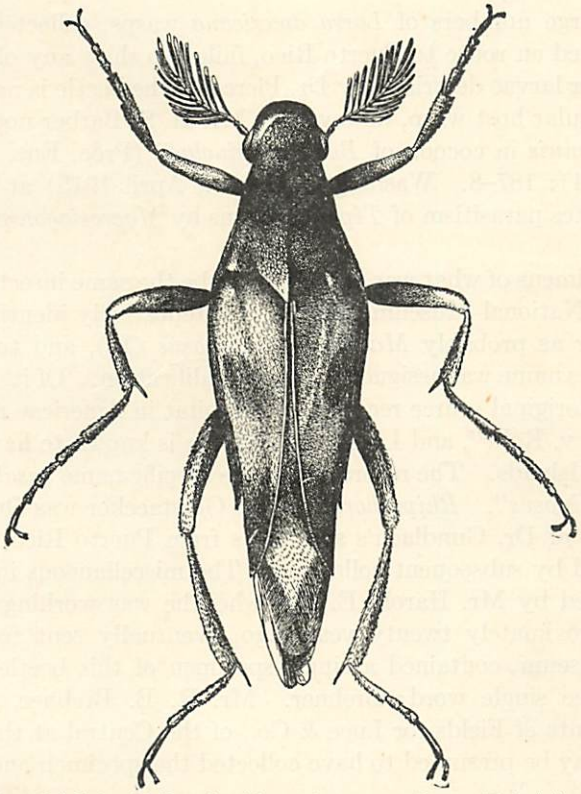
Mordellid beetles intercepted by Mr. R. G. Oakley on *Randia mitis* at Ponce were identified by Mr. H. S. Barber as a species of *Pentaria.* Mr. Eugene Ray identified some collected by Prof. J. A. Ramos at Mayagüez as being his **Pentaria multiplis,** previously known only from Cuba.

Naucles fasciata Ray (1939–312) was described from material collected at Ponce.

Rhipiphoridae

The Rhipiphorids are "wedge-shaped beetles resembling the Mordellidae closely in general appearance, but having the sides of the thorax without a sharp edge; hind body not terminating in a spinous process as in the Mordellids" according to Blatchley. Large and conspicuous Rhipiphorids are quite common on the flowers of "botoncillo" (*Borreria verticillata*) at Belém do Pará, Brasil, and when collections were being made there of the wasp *Larra americana* Saussure, in an attempt to introduce this natural enemy of the changa into Puerto Rico, some of these beetles were also collected, killed, pinned and mounted for the collection. One species, black with the anterior third of its elytra bright yellow, was identified by Mr. G. E. Bryant of the British Museum, as **Macrosiagon flavipennis** LeConte. In the list by Dr. R. E. Blackwelder (1945–480) it is given as

flavipenne LeC. 66–153, with a range from Mexico and the U. S. A., the United States records in Leng (p. 156) being "Pa. Ga. Ill. So. Cal. Conn." When intensive observations on botoncillo flowers, to note the dispersion of the introduced *Larra americana*, were commenced in Puerto Rico, what appears to be this species was found in considerable abundance in 1939 and 1940 at all points where releases of this wasp from Brasil had been



Adult of the Rhipiphorid Beetle, *Macrosiagon pectinatus* Fabricius, a parasite of continental *Tiphia*, eight times natural size. (After Davis.)

made, even including Luquillo, where it did not become established until years later. Specimens from Luquillo were sent to Dr. W. Dwight Pierce, a specialist in this group, concerning which he replied under date of September 30, 1941:

"The determination is correct. I have compared it with specimens from our central states and can find no distinguishing characters. It is a little of a puzzle as to whether this beetle has just recently come to Puerto Rico, or whether the collectors have merely failed to find it in

the past. Ordinarily these beetles are only found during the short season, and by rather specialized collecting at certain flowers and in the vicinity of the host nests. They undoubtedly lay their eggs in flowers and the young will hatch and cling to the legs or hairs on the body of host insects. If you will scrutinize your collections under the microscope, you may find some of these larvae clinging to the hairs of some of the wasps."

Search on large numbers of *Larra americana* wasps, collected in Brasil, which had died en route to Puerto Rico, failed to show any of the Rhipiphorid eggs or larvae described by Dr. Pierce. The beetle is not restricted to any particular host wasp, however, as Mr. H. S. Barber notes "*Macrosiagon flavipennis* in cocoon of *Bembex spinolae*" (Proc. Ent. Soc. Washington, **17** (4): 187–8. Washington, D. C., April 1915) at Brookland, D. C., and cites parasitism of *Tiphia* cocoons by *Macrosiagon pectinatus* F. in Illinois.

Other specimens of what was considered to be the same insect, submitted to the U. S. National Museum, were at first tentatively identified by Mr. H. S. Barber as probably *Macrosiagon spinosus* (F.), and to additional specimens this name was assigned without qualification. Of it, Mr. Barber writes, "The original source record was "Habitat in Americae meridionalis Insulis Dom. v. Rohr", and I believe von Rohr is known to have collected in the Virgin Islands. The record under the specific name *basalis* probably belongs to *spinosus*". *Rhipiphorus basalis* Gerstaecker was Quedenfeldt's identification of Dr. Gundlach's specimens from Puerto Rico, apparently not confirmed by subsequent collection. The miscellaneous insect collection assembled by Mr. Harold E. Box when he was working at Central Aguirre approximately twenty years ago, eventually sent to the U. S. National Museum, contained a single specimen of this beetle, unlabeled except for the single word: Brebner. Mr. R. B. Brebner, one of the Superintendents of Fields for Luce & Co., of the Central at the time Box was there, may be presumed to have collected the specimen and presented it to him.

If all these data are correct, we have a chain of evidence indicating (1) original collection in the Virgin Islands, (2) subsequent collection in Puerto Rico by Dr. Gundlach, and (3) later collection by Mr. Brebner for Mr. Harold E. Box. The apparent recent abundance is not real, and has no connection with the introduction of *Larra americana* from Brasil. But because of intensive observations on the insect visitors of botoncillo flowers, which these beetles haunt, many happened to be collected within a short period at many localities along the north coast of Puerto Rico. The beetles show considerable variation in both size and coloration, the largest

being half an inch long, and some have most of the elytra yellow. One individual has elytra entirely yellow, and reddish antennae.

Macrosiagon discicolle Gerstaecker is a much smaller beetle, of which three varieties: **mutilatus** Gerst., **melanoptera** Chevrolat and **quadrimaculatus** Gerst. are listed by Dr. Gundlach. The variety most common on botoncillo flowers is bright chestnut-red with black elytra. Another is entirely black, a third has only the posterior margin of the prothorax red, and the four-spotted one has been collected on seed pods of Jamaican sorrel at Bayamón.

Herr Quedenfeldt described (1886–128) as **major** a variety of *Rhipiphorus* (now **Macrosiagon**) **sordidum** Gerstaecker which Dr. Gundlach collected here.

Meloidae: Blister Beetles

Dr. E. A. Schwarz identified as a species of Zonitis the Meloid beetles which Mr. E. G. Smyth collected at light at Guánica in 1913. They are 11.0 mm. long, mostly dull yellow in color, median area of disc of prothorax and two large longitudinal bands on each elytron brown, and as they are apparently still unnamed, might appropriately be called **smythi.** Another **Zonitis,** of which a single specimen was collected at light at Guánica by Mr. E. G. Smyth on August 8, 1913, 16.0 mm. long, mostly dull yellow, but with areas of brown at base and near apex of the elytra, may be designated as **guanicana.**

Cissites maculata Swederus, identified by Dr. E. A. Schwarz as *Horia auriculata* Duges, from 15.0 to 20.0 mm. long, mostly orange-yellow, has two series of four black spots, to some extent tending to be confluent, on each elytron. It has been collected at Río Piedras, Mayagüez, Hormigueros and San Germán.

Epicauta annulicornis, described by Chevrolat (1877–ix) from specimens collected in Puerto Rico by Dr. Gundlach, has since been found only at Mayagüez, but of Chevrolat's **Epicauta obscuricornis,** described at the same time from Dr. Gundlach's material, no specimen has since been found.

Tetraonyx quadrimaculata F., found in many of the Lesser Antilles and the Virgin Islands, as well as in Cuba, Puerto Rico and the southern United States, was listed by Chevrolat, Drs. Stahl and Gundlach, and has been repeatedly collected since. It is mostly yellow, with black head and antennae, and with the legs black distad of the apex of the femora. Hardly more than the median third of each elytron is yellow, the black base and apex forming the four spots of the specific name. The beetles are possibly most often found on the flowers of leguminous plants in the more humid parts of the Island, but may occur on other kinds of flowers, as on flowers

"yerba bellaca" (*Croton humilis*) at Isabela, of *Lantana camara* at Trujillo Alto, and sometimes in such abundance as to cause appreciable injury, as on grapefruit blossoms at Bayamón, and on flowers of tecoma vine or "ricosolana" (*Pandorea ricasoliana*) at Isabela.

Stylopidae: Twisted winged Insects

Stenocranophilus quadratus, the Puerto Rican representative in a "Description of Two New Species of Strepsiptera (Halcotophagidae) Parasitic on Sugar Cane Insects" (Proc. Ent. Soc. Washington, **16** (3): 126–9. Washington, D. C., September 1914) by Dr. W. Dwight Pierce, was collected by Mr. Thos. H. Jones on October 14, 1912 at Río Piedras from the sugar-cane Fulgorid, *Delphax saccharivora* Westwood. A year later, additional material was obtained for study of the immature stages by Dr. Pierce, for this parasite is quite abundant, and is possibly one reason why its host is normally so scarce in Puerto Rican cane fields. Known only from Puerto Rico, outbreaks of its host, the sugar-cane "fly", have been of historic destructiveness in Barbados and Jamaica, presumably in part because this parasite is not present to minimize the abundance of the Fulgorid. The parasite will be noted extruding from between the abdominal segments of nymphs and adults of *Delphax*, but no attempt at working out its life-history has been made since the collection of the types by Mr. Jones.

Oedemeridae

Enormous numbers of restless, slender, iridescent blue-green or purplish Oedemerid beetles are sometimes to be found on beach vegetation, or attracted to lights in the spring, from April to June, on the north coast of Puerto Rico. Altho substantially similar in general appearance, they show considerable variation in size and color, and even in habits. Both the larger beetles with pinkish iridescence which dropped from bushes of seagrape at Pt. Salinas (the next point west of Palo Seco, fortified by the U. S. Army in World War II) when capture was attempted in June 1916, and the smaller greenish ones which flew when disturbed, were much more difficult to capture than those apparently feeding on the honey or pollen of the flowers of a *Metastelma* vine in the Condado in April of the same year, or those in May and June 1923 very abundant at Pt. Cangrejos resting on the stems, leaves and flowers of a common fleshy-leaved plant "jayajabico" (*Erithalis fruticosa*) with white, star-shaped flowers and purple berries. As these beetles are merely a nuisance when they swarm about lights of houses in the spring, no economic study of them has been made, and nothing is known of their immature stages. None of them answering to Chevrolat's

description of *Oxacis geniculata* from Puerto Rico, according to Mr. H. S. Barber, they were described in "Insectae Borinquenses" (1936–206) under the specific name of *litoris*. Prof. J. A. Ramos thinks that this description agrees perfectly with a single specimen which he collected on Mona Island in March 1944, listed by him (1947–37) under the name **Copidita (Asclera) litoris** Wolcott.

Copidita laeta Waterhouse, identified by Mr. J. M. Valentine as an *Oxacis* for Prof. J. A. Ramos of specimens collected at Guánica and Faro de Cabo Rojo, is listed by Dr. R. E. Blackwelder (1945–490) from Mustique, Grenada, Jamaica and Hispaniola.

Copidita lateralis Waterhouse, as doubtfully identified by Mr. H. S. Barber for material intercepted at San Juan and Bayamón, is the name given without qualification by Mr. J. M. Valentine to Oedemerids collected by Prof. J. A. Ramos at Mayagüez.

Copidita rubricollis, described by Charles O. Waterhouse (1878–309) from St. Thomas, and **Copidita tenella** Waterhouse, subsequently listed from St. Vincent, Jamaica and Hispaniola, should also occur on Culebra and Vieques, even if not in Puerto Rico itself.

A single Oedemerid, entirely dull violet-blue in color, collected on Sardinera beach, Mona Island, July 20, 1944, Prof. J. A. Ramos (1947–37) lists as a species of **Copidita (Asclera),** as determined by Mr. J. M. Valentine.

Others of this genus, as described by Mr. Valentine, are readily distinguished "with the prothorax brownish red, the eyes and antennae nearly black; the elytra with outer margins and a median longitudinal ridge whitish", first found by Dr. Stuart T. Danforth as very abundant on Desecheo Island on May 8, 1927, and determined by Mr. A. J. Mutchler as a new species of *Ditylus*. Because of this first collection, it might be well to designate these beetles as **Copidita (Asclera) desecheonis.** Prof. J. A. Ramos found one on Mona Island in June, and abundantly on weeds on the plateau in August 1944, and has in the collection many collected at Guánica in late July 1934 by Mr. C. M. Matos. The pubescent elytra of some are purplish, others are blue-green or horizon blue in color.

Oxacis geniculata, described by Chevrolat (1877–x) from Puerto Rican material collected by Dr. Gundlach, is listed by Drs. Gundlach and Stahl. As this species, Mr. J. M. Valentine identifies numerous specimens collected by Prof. J. A. Ramos on Mona Island in March and April, but the only specimen in the collection at Río Piedras corresponding to this abundant Mona Island material is a single specimen found by Mr. Francisco Seín at light in Santurce, April 10, 1922. In August 1939, Dr. Luis F. Martorell found these beetles very abundant on seagrape bushes on Mona

Island in the daytime, and swarming about lights at night. "This is the second most abundant and the largest Oedemerid on the Island. The head, except for the black eyes and infuscated basal segment of the antennae, and the entire prothorax are yellowish. The abdomen and elytra, except the outer and inner margins, are greyish-blue. The legs are light yellow, with the apical half of the femora strongly infuscated" according to Prof. Ramos (1947–38).

Sessinia vittata F., until quite recently called *Ananca*, was collected in Puerto Rico by Dr. Gundlach and listed by Chevrolat (1877–x), and by Leng & Mutchler from Vieques. Dr. Stuart T. Danforth subsequently collected it on Vieques, as well as from Humacao, Yauco, Faro de Cabo Rojo, Mayagüez and Añasco, and collections have also been made at Isabela, and at Pt. Cangrejos and Santurce on the north coast. It was especially abundant and troublesome at Aguirre in May 1916, and again in June 1923, as reported by Mr. F. S. Earle, forcing its way thru screens and around glass windows into houses at night. Mr. E. G. Smyth noted many attracted to light at Hda. Santa Rita, Guánica in July and August 1913. Superficially, it looks like a somewhat faded and browned specimen of *Oxacis geniculata*, for in life the elytra are often blue-grey, sometimes with only a narrow median band between very broad margins, but the legs are invariably entirely yellowish. Prof. J. A. Ramos (1947–38) personally collected a single specimen on Sardinera beach on Mona Island in April 1944.

Short descriptions of three distinctly different species of **Alloxacis,** as identified by Mr. J. M. Valentine, collected only on Mona Island, are given by Prof. J. A. Ramos (1947–38). The most abundant in the spring, "a very dull and dark blue species", was found feeding on the pollen of the flowers of "abeyuelo", *Colubrina ferruginosa.*

Scraptiidae

Cteniacantha marginata, described (1886–121) by Herr G. Quedenfeldt from Puerto Rican material collected by Dr. Gundlach and listed by him, has since been intercepted in the mountains north of Ponce and at Adjuntas by Mr. R. G. Oakley. Other interceptions in the mountains have been identified by Dr. E. A. Chapin as species of **Scraptia** and **Conomorphus,** and on mangrove at Guánica as **Canifa.**

Monommidae

Hyporrhagus marginatus F., as a *Monomma*, is reported from Puerto Rico by both Dr. Stahl and Dr. Gundlach, but of it no subsequent collection has been made.

Aspathines aenea Thomas, as identified by Dr. E. A. Chapin, has been

found on dead wood at Guayanilla and on mangrove at Ponce by Mr. R. G. Oakley.

Alleculidae (Cistelidae): Comb-Clawed Bark Beetles

Enormous numbers of elongate-oval brown beetles with golden pubescence, 5.0 to 6.0 mm. long, are sometimes to be found under dry seaweed and dead vegetation on the beach, or at night are attracted to lights in houses near the beach. They have been found hiding under the loose bark of lignum-vitae or "guayacán" (*Guaiacum officinale*) and of snake-bark or "abeyuelo" (*Colubrina ferruginosa*) at Guánica, and Mr. R. G. Oakley found them repeatedly at Ponce, on "ucar" (*Bucida buceras*) and other trees. Possibly their most interesting hiding place, beside the squares and bolls of cotton, is in the empty pupal skins of the cotton caterpillar, *Alabama argillacea* Hübner, observed at Hatillo. At Pt. Cangrejos, they were noted hiding in cavities in the stems of dead or injured castor bean plants, and in an investigation to determine the number of animals present in three square feet of pasture near the beach (in February 1920, before all this region had been so closely built up as to form a suburb of Santurce), seven of these beetles were found. Quantitatively, this indicates their abundance at particular times, not their entire absence at other times. They are eaten by the iguana, *Ameiva exsul*, but Dr. Wetmore noted none in the stomach contents of any of the beach-inhabiting birds that he collected. Two observations, in February and June, have been made of their exceptional abundance on "malvavisco", *Corchorus hirsutus*, at Pt. Cangrejos, and in September on Mona Island, in a few of these plants on the edge of the air-strip near the beach where two or three beetles were hiding in the folds of nearly every leaf, or in the terminal buds. They were merely resting, not feeding, and indeed little is known of their habits or immature stages, for they are definitely of no economic importance, having never been noted injuring any economic plant, or any other. In August 1939, Dr. Luis F. Martorell found them very abundant on a weed locally known on Mona Island as "té", and they have been collected at light on Mona in March, April, June, July and September. Concerning their identity, Dr. Gundlach lists *Allecula flavipes* J. Duval in synonymy with *Allecula fuscula* Schönherr, the latter name only being given by Quedenfeldt. Some of the specimens from Pt. Cangrejos were identified by Dr. E. A. Schwarz as a species of **Hymenorus,** and Mr. K. G. Blair of the British Museum tentatively gave the name *Hymenorus fuscula*. Mr. A. J. Mutchler labeled one specimen *Hymenorus fuscula*? Fab., but Dr. E. A. Chapin called the recent collections from Mona probably a new species of *Hymenorus*. If a specific name is needed for the Mona Island-Puerto Rican species, it might well be **corchorophilus.**

Tenebrionidae: Darkling Beetles

Treintoma varvasi Solier, as determined by Dr. C. W. Leng, was collected by Dr. Stuart T. Danforth at Ensenada in February 1927, and by students of his at Guánica in April 1931. On Mona Island, Prof. J. A. Ramos reports (1947–39) sweeping specimens from vegetation on Uvero beach in July and August, 1944.

Diastolinus fuscicornis, described by Chevrolat (Ann. Soc. Ent. France, (5), VII Bulletin, p. viii. Paris, 1877) from material collected by Dr. Gundlach, has not since been found.

Opatrinus pullus Sahlberg (=*anthracinus* Mulsant), first determined by Dr. E. A. Schwarz as *Hopatrinus*, from specimens collected at the base of decaying pineapple slip, is a shining black beetle 10.0 mm. long, with deeply punctate elytra and minutely and evenly punctate head and pronotum. It has since been collected by Dr. Stuart T. Danforth or his students at Ensenada, Mayagüez, Añasco, Coamo and Tortuguero, and most recently at light on Mona Island by Dr. Luis F. Martorell.

Blapstinus punctatus F., as determined by Mr. A. J. Mutchler, is a dull black beetle, 5.0 mm. long, which Dr. Stuart T. Danforth reported as doing considerable damage to tobacco seedlings and melons at Algarrobo in February 1931. This is the only record of attack on cultivated crops, however, despite periods of temporary abundance of these beetles, especially in the more xerophytic parts of Puerto Rico. In Tablón No. 9, Hda. Santa Rita, Guánica, in December 1914 they were so numerous that whenever an old stool of cane was broken up, dozens would scurry for cover. The smallest piece of trash or chunk of dirt seemed to offer them all the concealment necessary. At Boquerón they have been found in like abundance hiding under every slab of dry cow dung, where the hard unbroken crust of dry soil offered no other chance at concealment. Dr. Stuart T. Danforth and/or his students have also collected these beetles at La Plata, Faro de Cabo Rojo, Tortuguero, Humacao and Luquillo, Mr. R. G. Oakley found them at Jayuya, and Dr. Luis F. Martorell first noted them at light on Mona Island.

Blapstinus striatulus Melsheimer, as tentatively identified by Dr. E. A. Chapin, are similarly dull black beetles, reported as attacking sprouting cotton seedlings at Isabela in June 1931.

Sellio tibidens Quedenfeldt, as tentatively identified by Mr. K. G. Blair of the British Museum, is 6.0 to 7.0 mm. long, with elytra decidedly constricted just distad of the base, and broadest at the middle. They were found abundant under dry cow dung at Boquerón and at Salinas in the summer of 1923. Dr. Stuart T. Danforth had specimens from Desecheo Island. When alive they have a noticeable bluish bloom which is not apparent in the museum specimens.

Trachyscelis flavipes Melsheimer, as tentatively identified by Mr. K. G. Blair, is a small black beetle, hairy beneath, found on the beach at Pt. Cangrejos in January 1923. Other individuals, collected by Dr. Stuart T. Danforth at Río Piedras in August 1931, were considered a new species by Dr. E. A. Chapin.

Concerning **Phaleria variabilis,** described by G. Quedenfeldt (1886–128) from Dr. Gundlach's material from Puerto Rico, Gundlach says in his list: "esta especie varía mucho en su colorido que puede ser totalmente el pálido amarillo hasta casi el solo negro, o amarillo con una mancha común oscura en forma de luna sobre el disco de los elitros". Dr. E. A. Chapin identified as this species the beetles and larvae found in the claws of dead crabs on the beach at Isabela, and tentatively some adults at light on Mona Island, Mr. A. J. Mutchler adults found under seaweed on the beach at Pt. Cangrejos, and Dr. A. G. Böving those under seaweed at Cataño and Santurce. Previously, specimens showing the same variation in coloration, collected under seaweed at Pt. Cangrejos, were identified by Dr. E. A. Schwarz as **Phaleria angustata** Chevrolat, described by him in 1878, and Dr. R. E. Blackwelder thus identified the material collected by Prof. J. A. Ramos on Mona Island. It seems possible that both names apply to the same, very variable insect.

Dr. Wetmore reports finding in the stomach contents of the killdeer beetles identified as a species of **Crypticus,** and Dr. E. A. Schwarz gave this name, "possibly **obsoletus** Say" to others of these dull black beetles, 3.0 to 4.0 mm. long, collected on seaweed on the beach at Pt. Cangrejos, and to 13 such beetles found there in three square feet of pasture. They have since been found in a pasture at Camuy, and by Prof. J. A. Ramos at Hatillo and Mayagüez, and on Mona Island.

Eutomus cornutus Arrow, as determined by Dr. E. A. Chapin, has been found in a tree fungus at Mayagüez.

Eutomus micrographus Lacordaire, determined by Dr. E. A. Schwarz as a *Rhipidandrus*, is a dull black beetle, 4.0 mm. long, of which many adults and larvae were found in a polypore fungus, *Fomes australis*, at Jájome Alto and at Adjuntas.

Diaperis hydni Fabricius, now less happily called *maculata* Olivier, is the other common beetle feeding on polypore shelf fungi in Puerto Rico and on Mona Island. Adults are broad, 5.0 to 7.0 mm. long, with basal half of the elytra chestnut red in color. This species was listed by Drs. Stahl and Gundlach, and has repeatedly been collected since, the most recent identification of the fungus being of *Polyporus palmarum* on coconut palm.

Beetles found in a polypore fungus on El Yunque have been identified by Dr. E. A. Chapin as belonging in a "genus near *Pentaphyllus*".

Palembus ocularis Casey, a light yellow-brown beetle, 4.0 mm. long, and its larvae have been found feeding on tamarind seeds, intercepted at Loíza, and noted on this host by Prof. J. A. Ramos at Faro de Cabo Rojo, but the original determination by Dr. E. A. Schwarz was of an individual collected on the ground at Pt. Cangrejos. Mr. R. G. Oakley also found these beetles on sedges at Ponce and at Cabo Rojo.

Of the numerous species of **Platydema,** Dr. Gundlach lists **apicalis** Laporte & Brullé, not since collected, and **picicornis** Fabricius, later found by Dr. Donald DeLeon under the bark of almácigo logs at Guánica. To numerous small black oval beetles found in dead almácigo (*Bursera simaruba*) infested by the termite *Nasutitermes costalis* Holmgren at Vega Baja, Mr. G. E. Bryant gave the name **Platydema excavata** Say, and Mr. J. A. Mutchler independently also made the same determination. Dr. Alex. Wetmore lists **Platydema virens** Laporte & Brullé as having been eaten by the black and white warbler, and this or other species by the woodpecker, oriole and grasshopper sparrow.

Numerous small beetles intercepted by Mr. R. G. Oakley in decaying tree fern (*Cyathea arborea*) or in decaying wood at Adjuntas, Villalba and in the mountains above Yauco at Indiera, have been identified by Dr. E. A. Chapin as a species of **Dioedus.**

Gnathocerus cornutus F., as identified by Mr. H. S. Barber, has been found in a tree fungus at Aibonito.

Gnathocerus maxillosus F., as identified by Dr. R. E. Blackwelder, was found at Guánica under the bark of almácigo trees by Dr. Donald De Leon, and under the bark of leguminous trees in the patio of the School of Tropical Medicine by Dr. W. A. Hoffman.

Tribolium castaneum Herbert (= *T. ferrugineum* Dej.), a dark reddish, elongate, flattened beetle, commonly known as an economic pest of flour, bran and similar stored products, was found by Dr. W. A. Hoffman under the bark of a leguminous tree in the patio of the School of Tropical Medicine. In Puerto Rico, this beetle has been found in dry peas, dry ganduls, chicory beans, dry tamarind pods at Guánica, dry cotten seed meal in a tobacco warehouse at Cayey, and most recently in the cotton ginnery at Isabela in which baled cotton and cotton seed in guano palm sacks from Hispaniola was stored. Together with the quite similar **Tribolium confusum** DuVal, also found in Puerto Rico, attacking similar dried food products, these two cosmopolitan pests may cause very considerable injury if allowed to breed undisturbed. Flour in tough paper sacks is much less readily infested than in cloth sacks, while that brought to the Island in bulk is most subject to injury. While fumigation is possible, most wholesale grocers and bakers anticipate only small shipments of flour at any one time, and plan to get rid of any infested flour quickly before they suffer much loss. Indeed,

the simplest and cheapest and most practical method of control in the tropics is prompt consumption by human beings of the food product.

First noted in Puerto Rico by Dr. Richard T. Cotton in wheat flour, is what he describes in his "Insect Pests of Stored Grain and Grain Products" (pp. 242, illus. Minneapolis, 1941) as a "cosmopolitan insect found in damp situations breeding in grain and cereal products that are spoiled or out of condition: the lesser meal worm, **Alphitobius diaperinus** Panzer. It causes no damage to grain that is sound and dry. The adult is black, or a very dark reddish brown, and measures from three to four-sixteenths of an inch in length. The larva is yellowish brown and similar in appearance to young larvae of the true meal worm".

"The black fungus beetle, **Alphitobius piceus** Olivier, is closely related to the lesser meal worm, . . . and has similar habits. In the lesser meal worm, the surface of the thorax is finely and sparsely punctuated, whereas in the black fungus beetle the surface of the thorax is coarsely and profusely punctuated". Of it in Puerto Rico, as *Heterophaga fagi* Panzer, Dr. Gundlach writes, "encontrado en almacenes y en lugares donde existen substancias descompuestas y secas". It has most recently been found in the cotton ginnery at Isabela, and Prof. J. A. Ramos noted it in a store-room for cattle feed at Mayagüez.

Sitophagus hololeptoides Castelnau, listed by Dr. Gundlach under Chevrolat's MS name of *Adelina livida*, has been recently collected at Mayagüez, and at Añasco by Prof. J. A. Ramos.

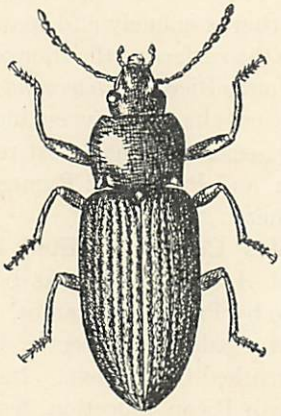
Doliema pallida Say, is a pale yellow beetle, 4.0 mm. long, so flat that it appears to have been crushed from above. Its head is concave between the eyes. The first Puerto Rican collection, from under bark of a fence post at Boquerón, was determined by Mr. K. G. Blair of the British Museum, but numerous subsequent collections have been made from similar xerophtic localities: under bark of almácigo at Guánica, and on stump at Ponce, the most recent being from Mona Island, where repeated collections from under loose bark of fence posts would indicate it as being quite common.

Corticeus rufipes F., identified as a *Hypophloeus* by Dr. E. A. Schwarz from material collected under bark of dead "bucare" (*Erythrina poeppigiana*) trees at Cayey by Dr. Richard T. Cotton, is a very elongate, cylindrical, shining brown beetle, since found under bark of dead flamboyán (*Delonix regia*) at Río Piedras, in dry branches of "burro" (*Capparis flexuosa*) at Santa Isabel, and at Mayagüez.

Zophobas morio F. is by far the largest Tenebrionid beetle occurring in Puerto Rico, adults being from three-fourths to seven-eighths of an inch long, entirely dull black or faintly bluish in color. Of it, Dr. Gundlach states, "se encuentra en las casas debajo de tablas, cajones, etc. Nunca

lo he visto en el campo". Leng & Mutchler list it from Culebra Island. *Zophobas rugipes* Kirsch is the determination by Mr. A. J. Mutchler of specimens from the Corozal cave, and from many other localities collected by Dr. Stuart T. Danforth and his students, but he was unable to note any distinguishing characteristics separating it from the other species. Records of collection are from all parts of Puerto Rico. The beetles are eaten by the introduced toad, *Bufo marinus*, and by the endemic iguana, *Ameiva exsul*. Nothing is known of the immature stages.

Dr. Richard T. Cotton may be quoted on the two species of meal worms which occur in Puerto Rico: "the yellow meal worm, **Tenebrio molitor** L., which was described by Linne in 1758 and the dark meal worm, **Tenebrio obscurus** F., which was described by Fabricius in 1792. The yellow meal



The Tenebrionid Beetle, *Zophobas morio* Fabricius, twice natural size. (Drawn by Fritz Maximilien.)

worm is so named because of its honey-yellow color. It is also known as the European meal worm because of the many reports of its occurrence in Europe. The meal worms are inclined by nature to be scavengers, and prefer to feed on decaying grain or milled cereals that are damp and in poor condition. They are usually found in dark, damp places". None was collected by Dr. Cotton while he was here, but Dr. Stuart T. Danforth and students have made innumerable collections at Mayagüez and at other localities in the western end of the Island, including, surprisingly enough, one of *T. molitor* on Desecheo Island. The adults are "elongate, narrowly oval, piceous or dark reddish-brown, opaque, 13.0 to 17.0 mm. long", and in that stage the two species are almost indistinguishable.

Mr. R. G. Oakley intercepted at Yauco some beetles identified by Dr. E. A. Chapin as a species of **Lorelopsis.** The only West Indian species of

this genus is *Lorelopsis pilosa*, described by G. C. Champion from St. Vincent.

Dr. Alex Wetmore reports the woodpecker, flycatcher, wood pewee, vireos, warblers and the oriole as eating beetles identified for him as a species of **Helops**, but no previous or subsequent collections by entomologists have been made that correlate with what he found so abundantly in these birds' stomachs.

Pyanisia tristis Laporte, reported as a *Cymatothes* by Drs. Stahl and Gundlach, has not since been found locally.

Strongylium pulvinatum was described from Puerto Rico by F. W. Mäklin (Acta. Soc. Sci. Fennicae, 8 (1): 265) in 1867, and Dr. Wetmore reports finding a beetle of this genus in the stomach contents of Latimer's vireo.

Talanus insularis Mäklin is doubtfully reported from Puerto Rico in the list of Dr. R. H. Blackwelder (1945–543).

Cisidae

Mr. R. G. Oakley intercepted on dead tree at Ponce, in decaying wood at Añasco and in fungus at Mayagüez what Mr. W. S. Fisher identified as species of **Cis.**

Ennearthron delicatulum J. DuVal, listed by Dr. Gundlach, is represented in a recent collection of a beetle of this genus in decaying wood at Añasco.

Prof. J. A. Ramos found abundant on fungi on Sardinera beach, Mona Island, what Mr. W. S. Fisher identified as a species of **Ceracis.**

Cerambycidae: Long-Horned Wood-Boring Beetles

Parandra cribrata Thomson and **Parandra cubaecola** Chevrolat, both re-reported from Puerto Rico by Leng & Mutchler, are possibly the least typical of the Cerambycidae. Only the first is represented by recent collections: at Villalba by Mr. R. G. Oakley, and on the floor of the camp at El Verde, in the Luquillo Mountains above Río Grande. These shining, parallel-sided, reddish-brown beetles, three-quarters of an inch long, have antennae inserted at the side of the head near the base of the mandibles barely reaching to base of the thorax. Dr. Alex. Wetmore reported the remains of one of these beetles in the stomach contents of an owl, and their occurrence is presumably confined to the higher forests.

With the jaws of the males three-quarters of an inch long, and total length approaching three inches, some species of *Stenodontes* (*Mallodon* or *Nothopleurus*) are among the largest beetles occurring in Puerto Rico, altho they are only three-quarters of an inch wide, and not nearly so thick and solid as the rhinoceros beetles. The females have much smaller man-

dibles, but more deeply serrate and more extended lateral margins of the prothorax. All are shining light brown. They are not abundant, and the only definite host record is of an adult in an oval tunnel in a live guácima (*Guazuma ulmifolia*) at Salinas, altho others have been found on dead stumps, or resting on trunks of dead trees on the ground. Mr. W. S. Fisher identified as **Stenodontes bituberculata** Palisot de Beauvois some unlabeled specimens, presumably collected at Guánica, the Danforth collection contains others from Mayagüez and Añasco, and Dr. Luis F. Martorell found one on Mona Island, resting on an old stump of a tree at Rancho Grande.

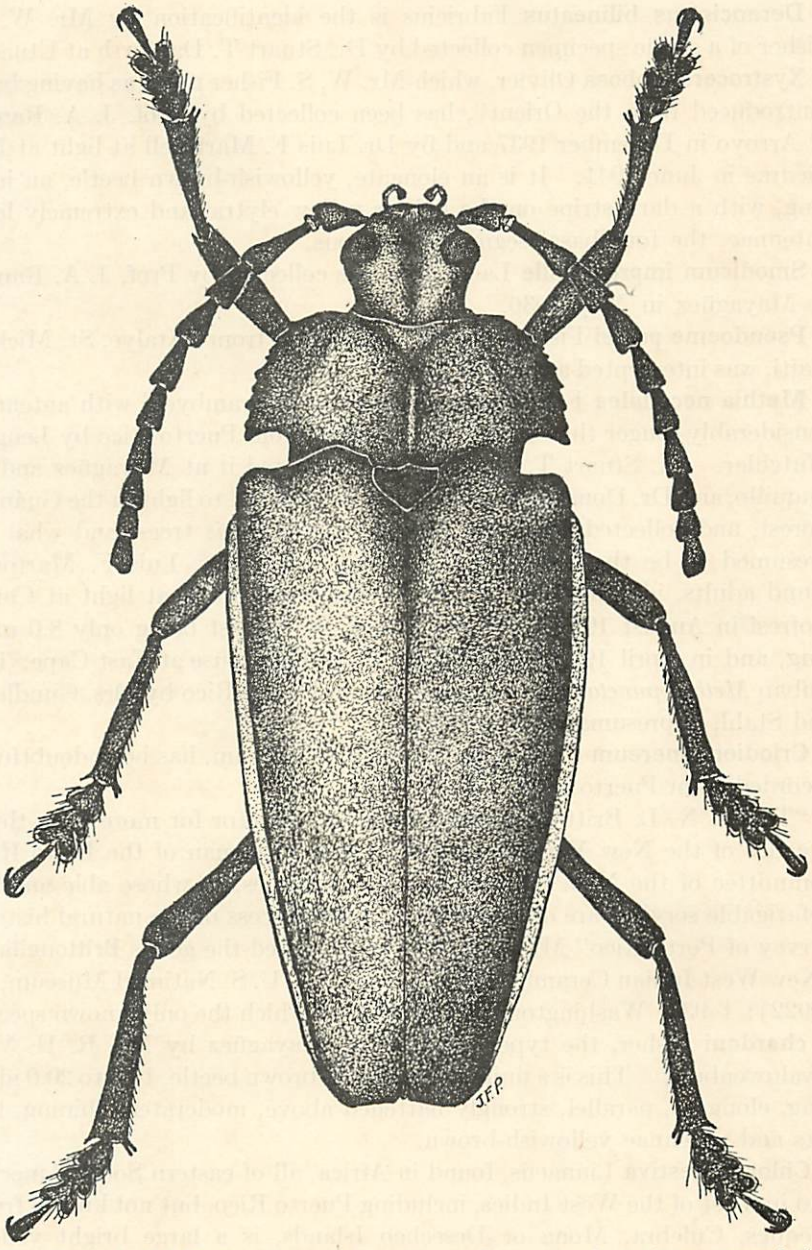
Stenodontes exserta Olivier, as identified by Mr. W. S. Fisher, is represented in the Río Piedras collection by one taken at light at Ceiba. This is what Drs. Stahl and Gundlach report as *Stenodontes mandibularis* F., known also from Mona Island.

Stenodontes maxillosus Drury, listed as a *Mallodon* by Drs. Stahl and Gundlach, is unrepresented in recent collections, and in doubt is the record of the subspecies *bajulus* Erichson of *Stenodontes dasystomus* Say, and Dr. Stahl's of *Stenodontes damicornis* Linnaeus.

Callipogon proletarium described, as a *Callomegas* by A. Lameere (Ann. Soc. Ent. Belgique, **48:** 66. Brussels, 1904) from Puerto Rico, is an even larger beetle, represented in recent collections by one found on stump at Lares, September 8, 1921, as identified by Dr. E. A. Schwarz.

Callipogon sericeum Olivier, listed as an *Orthomegas* by Drs. Stahl and Gundlach, is represented in recent collections by a male with curved and deeply sculptured jaws found by Mr. R. W. Johnson at Mayagüez. The specific name is most appropriate, as the beetle has a grey, mouldy appearance, due to the uneven, scattering silvery pubescence.

Derancistrus thomae Linnaeus, listed for Puerto Rico by Dr. Stahl as *Solenoptera lateralis* Chevrolat, and by Dr. Gundlach as a *Prosternodes*, is a comparatively common elongate, reddish-brown Cerambycid, varying in length from an inch and three-eighths to only five-eighths of an inch for the smallest individuals. It has prominent antennae, extending half way down the elytra margined with yellow. Dr. Alex. Wetmore reports it eaten by the kingbird, and Dr. Stuart T. Danforth by the lizard cuckoo. It has been collected in all parts of the Island, and abundant larvae found under the bark of fence posts or rotten stumps have been repeatedly reared to adult. Presumably any kind of unbarked dead or rotting wood will serve, those identified being "cedro" (*Cedrela mexicana*) at El Verde, "achiote" (*Bixa orellana*) at Lares, and "camasey" (*Henrietella fascicularis*) at Aguas Buenas, besides many others not recognized. From the incomplete rearing records, one may approximate the larval period as two months, that of the pupa as two weeks.



The Cerambycid Beetle, *Derancistrus thomae* Linnaeus, four times natural size. (Drawn by José F. Pietri.)

Derancistrus bilineatus Fabricius is the identification by Mr. W. S. Fisher of a single specimen collected by Dr. Stuart T. Danforth at Utuado.

Xystrocera globosa Olivier, which Mr. W. S. Fisher notes as having been "introduced from the Orient", has been collected by Prof. J. A. Ramos at Arroyo in December 1937 and by Dr. Luis F. Martorell at light at Río Piedras in June 1941. It is an elongate, yellowish-brown beetle, an inch long, with a dark stripe on the lighter yellow elytra, and extremely long antennae, the four basal segments scabrous.

Smodicum impressicolle Lacordaire was collected by Prof. J. A. Ramos at Mayagüez in May 1936.

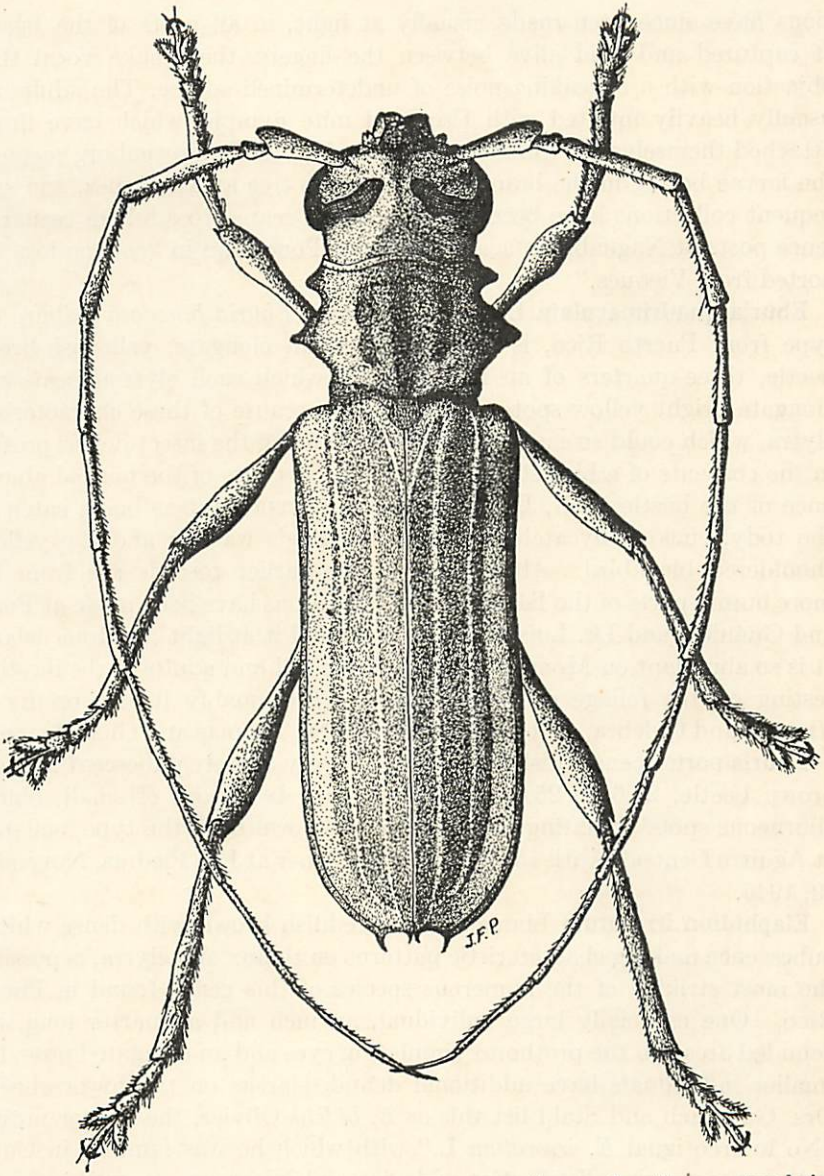
Pseudoeme poolei Fisher, originally described from l'Atalye, St. Michel, Haiti, was intercepted at light at San Juan.

Methia necydalea Fabricius, a slender little Cerambycid with antennae considerably longer than its body, was listed from Puerto Rico by Leng & Mutchler. Dr. Stuart T. Danforth had collected it at Mayagüez and at Luquillo, and Dr. Donald De Leon found it attracted to light in the Guánica Forest, and collected adults on *Eugenia* and *Amyris* trees, and what he presumed to be the larvae in their dead twigs. Dr. Luis F. Martorell found adults, identified by Mr. W. S. Fisher, common at light at Camp Kofresí in August 1939, on Mona Island, the largest being only 8.0 mm. long, and in April 1940 found others at the lighthouse at East Cape. The Cuban *Methia punctata* Leconte, listed from Puerto Rico by Drs. Gundlach and Stahl, is presumably this species.

Criodion cinereum Olivier, described from Surinam, has been doubtfully recorded from Puerto Rico.

"To Dr. N. L. Britton, eminent botanist, director for more than three decades of the New York Botanical Garden, chairman of the Porto Rico committee of the New York Academy of Sciences, to whose able and indefatigable services are due in large part the success of the natural history survey of Porto Rico" Mr. W. S. Fisher dedicated the genus **Brittonella** in "New West Indian Cerambycid Beetles" (Proc. U. S. National Museum, **80** (2922): 1–93. Washington, D. C., 1932), of which the only known species is **chardoni** Fisher, the types collected at Mayagüez by Mr. R. H. Van Zwaluwenburg. This is a uniformly reddish-brown beetle, 17.0 to 20.0 mm. long, elongate, parallel, strongly flattened above, moderately shining, the legs and antennae yellowish-brown.

Chlorida festiva Linnaeus, found in Africa, all of eastern South America and in most of the West Indies, including Puerto Rico, but not known from Vieques, Culebra, Mona or Desecheo Islands, is a large bright yellow Cerambycid, often an inch long, with elytra mostly light green in color. The apex of each elytron bears two spines, and the lateral margins of the prothorax have less pronounced spines. Above, the prothorax bears the



The Cerambycid Beetle, *Chlorida festiva* Linnaeus, four or five times natural size. (Drawn by José F. Pietri.)

darkened marking of a three-branched candelabra. The dark antennae are considerably longer than the body. Listed by Drs. Gundlach and Stahl, Dr. Alex. Wetmore found it eaten by the ani. Innumerable collec-

tions have since been made, usually at light, in all parts of the Island. If captured and held alive between the fingers, they make vocal their objection with a squeaking noise of undetermined source. The adults are usually heavily infested with Uropodid mite nymphs which have firmly attached themselves to the thorax. Mr. R. H. Van Zwaluwenburg recorded the larvae boring in the branches of a mango tree at Mayagüez, and subsequent collections have been made of larvae reared to adult in casuarina fence posts at Naguabo, in acacia stump at Ponce and in "cobana logs imported from Vieques."

Eburia quadrimaculata Linnaeus, of which *Eburia binodosa* Gahan, the type from Puerto Rico, is a synonym, is an elongate, yellowish-brown beetle, three-quarters of an inch long, of which each elytron bears two elongate bright yellow spots. Presumably because of these characteristic elytra, which could so easily be recognized among the insect debris present in the contents of a bird stomach, as well as because of the normal abundance of the beetle itself, Dr. Alex. Wetmore reports it as being eaten by the tody, cuckoo, flycatcher, vireos, Adelaide's warbler and the yellow-shouldered blackbird. Altho most of the earlier records are from the more humid parts of the Island, recent collections have been made at Ponce and Guánica, and Dr. Luis F. Martorell found it at light on Mona Island. It is so abundant on Mona, indeed, that one will find adults in the daytime resting on the foliage or twigs of trees. Presumably it also occurs on Vieques and Culebra, as it is recorded from St. Thomas and Guadeloupe.

Eburia portoricensis Fisher (1932–15), a very densely pubescent reddish-brown beetle, 20.0 to 25.0 mm. long, "with two pairs of small, oblong eburneous spots" ornating each elytron, is known from the type, collected at Aguirre Central, April 15, 1930, and one other at Río Piedras, November 19, 1945.

Elaphidion irroratum Linnaeus, dark reddish brown with dense whitish pubescence making characteristic patterns on thorax and elytra, is possibly the most striking of the numerous species of this genus found in Puerto Rico. One especially large individual, an inch and a quarter long, has denuded areas on the prothorax simulating eyes and an elongated nose, but smaller individuals have additional denuded areas on the lower cheeks. Drs. Gundlach and Stahl list this as *E. bidens* Olivier, the former noting, "No lo creo igual *E. irroratum* L." with which he was familiar in Cuba. It has an extensive distribution: Mexico and Nicaragua, as well as in the West Indies, Dr. Luis F. Martorell having found it abundant at light on Mona Island. He reared one adult of this species, as well as *Elaphidion spinicorne* Drury, from a dead trunk of *Albizia lebbeck* lying on the side of the Ponce road, and also adults of the Elaterid, *Chalcolepidius silbermanni* Chevrolat, a recent accidental introduction from Hispaniola, the

larvae of which are predaceous on Cerambycid larvae in their tunnels in dead tree trunks.

Elaphidion spinicorne Drury, with antennae scarcely more spiny than those of *irroratum*, and similarly dark reddish-brown, has dense yellowish pubescence spotting the elytra and normally denuded mostly along the median dorsal keel of the prothorax. Listed by Drs. Gundlach and Stahl, it occurs in all parts of Puerto Rico, recent collections having been made at Lares and Humacao, but is much more abundant on the xerophytic south coast, and on Mona Island, where it has repeatedly been collected.

Elaphidion mutatum Gahan (= *E. tomentosum* Chevrolat) is somewhat smaller, the greyish pubescence of the elytra being arranged in elongated areas. In fresh specimens, as those reared from prunings of crape myrtle (*Lagerstroemia indica*) by Dr. Luis F. Martorell at Río Piedras, such denudation is less noticeable. Larvae have also been reared to adult at Río Piedras in the wood of "cupey" (*Clusea rosea*), and adults collected at Palo Seco, Cayey and Maricao. The greyish pubescence of individuals rather doubtfully identified as this species by Mr. W. S. Fisher, collected by Mr. Miguel A. Pérez from a live tree of "aceitillo" (*Zanthoxylum flavum*) at Guánica, is entirely undenuded, even the spiny antennae being densely pubescent in the least rubbed individuals.

Elaphidion insulare Newman, barely half an inch long even in the largest specimens, and with apparently more spiny antennae because of its small size, has grayish pubescence in more or less elongated areas on the elytra of denuded individuals. Collected at Ponce and Mayagüez, and by Mr. Miguel A. Pérez on Mona Island, as determined by Mr. W. S. Fisher, it also occurs in the more humid parts of Puerto Rico, adults having been reared from larvae in hormiguilla-infested dead twigs that had fallen from the twin "jagüey" (*Ficus laevigata*) tree on the side of the road between Manatí and Ciales.

Elaphidion portoricensis Fisher (1932–33), of which the type is from Coamo Springs, others from Yauco and Ponce, is a "uniformly bright reddish brown, strongly shining,—each elytron with three white pubescent spots," the entire beetle being 8.0 to 11.0 mm. long.

Elaphidion nanum Fabricius, which Dr. Gundlach listed as *E. cinereum* Olivier, is only half an inch long in the largest individuals: yellowish-brown, with the lateral ridges of the prothorax more prominent and usually more denuded than the dorsal keel, more or less elongated denuded areas on the elytra. It occurs on Vieques Island, where it was collected by Dr. Stuart T. Danforth, but not on Mona Island, despite its occurrence in Hispaniola. Numerous collection of adults, usually at light, have been made in all parts of Puerto Rico, but nothing is known of the immature stages.

Elaphidion thomae Gahan has been found at San Germán and at Bayamón.

Elaphidion glabratum Fabricius, as doubtfully determined by Mr. W. S. Fisher, was collected at Utuado by Dr. Stuart T. Danforth.

Elaphidion conspersum Newman, described from Hispaniola, was collected at light, Sardinera beach, Mona Island, by Prof. J. A. Ramos, in April 1944.

Stizocera vanzwaluwenburgi, described by Mr. W. S. Fisher (1932–46) from specimens collected at Mayagüez, and others at San Germán and Coamo Springs, is "narrowly elongate, subcylindrical; above pale yellow, beneath brownish-yellow", varying in size from 11.5 to 19.0 mm. in length. Apparently this slender beetle is confined to the western end of Puerto Rico, all subsequent collections made by Dr. Stuart T. Danforth or his students are from Mayagüez and Añasco, the farthest east being Coamo on the south and Algarrobo (Tortuguero Lagoon) on the north.

Dr. Alex. Wetmore reports in the stomach contents of the owl and the flycatcher remains considered to be that of a species of *Compsa*, but possibly assignable to the former or one of the following.

Heterachthes ebenus Newman, as determined by Mr. W. S. Fisher, was collected by Prof. J. A. Ramos (iv–37) at Mayagüez.

Heterachthes quadrimaculata Fabricius, found in the Lesser Antilles, was first identified from Puerto Rico by Dr. E. A. Schwarz. It is a very slender beetle, cylindrical, normally about half an inch long, the four light yellow spots on the somewhat darker elytra far from prominent. Since the first collection at Guánica, it has been repeatedly found at Ponce, and in the mountains at Utuado and Lares, as well as on the north coast at San Juan and Pt. Cangrejos.

Cylindera flava Fabricius, 7.0 to 10.0 mm. long, shining, flattened, entirely yellowish, occurs in the Old World, as well as in Hawaii, Mexico, British Guiana, Florida, the Bahamas and most of the West Indies. Drs. Gundlach and Stahl list it from Puerto Rico as *Lampromerus pilicornis* F., and it is so common here generally that Mrs. Raquel Dester found it eaten by the introduced toad, *Bufo marinus*. Dr. Donald De Leon noted the "saffron yellow" larvae feeding between the wood and the bark of beefwood (*Casuarina equisetifolia*) logs at Guánica in April 1940, and pupating in the bark. In July 1937, Miguel A. Pérez and Luis F. Martorell had noted logs of "ucar" (*Bucida buceras*) on the beach at Guayanilla heavily infested. It is not very common on Mona Island, Dr. Martorell finding only one at light at Camp Kofresí in August 1939, and Prof. J. A. Ramos (1947–42) one other five years later.

Merostenus attenuatus White, listed as a *Lampromerus* by Dr. Gundlach, has since been collected at Ponce by Mr. R. G. Oakley on flowers of *Scirpus*

validus, and Dr. Luis F. Martorell found a single specimen at light on Sardinero beach, Mona Island in March 1940.

Plectromerus distinctus Cameron, a Hispaniolan species, has been reported from Puerto Rico.

Acyphoderes aurulenta Kirby, described from Brasil and formerly known only in addition from Argentina, listed by Drs. Gundlach and Stahl from Puerto Rico as *Odontocera abdominalis* Olivier, was first correctly identified from Puerto Rico by Mr. G. E. Bryant, the synonymy subsequently being published (Proc. U. S. National Museum, **77** (2842) Art. 19:12. Washington, D. C., 1930) by Mr. W. S. Fisher. Densely pubescent with bright golden yellow hairs, the elytra acutely triangular, showing the hind wings beneath, the basal segments of the antennae spinose, the apical ones flattened, these unique beetles display such varied characters that, when found resting on leaves or flowers, they are easily mistaken for some unique bee. Rarely collected at light, the beetles seem to have no connection with wood or trees, having been observed resting on cane leaves, in the midst of extensive cane fields, as at Coloso and at Toa Baja; on mango blossoms, as at Mayagüez, on leaves of *Psidium guajava*, as at Cayey, and at light at Ponce. Nothing is known of the immature stages.

Euryscelis suturalis Olivier is dull reddish brown, densely covered with erect dull yellow hairs, the inner half of the narrow elytra with recumbent whitish pubescence. It has extremely long legs, the femora and tibiae being each half an inch long, of a beetle only three-quarters of an inch in total length. Noted by Mr. Francisco Seín on October 17, 1925 at Guayama, where at 5 o'clock in the afternoon he found the adults running briskly over logs of mesquite or "bayahonda" (*Prosopis juliflora*) imported from Santo Domingo, it had previously been established in Puerto Rico, for nine years before collections had been made at light at Aguirre, and subsequently at San Juan and Bayamón, all identifications made by Mr. W. S. Fisher. Presumably this beetle is endemic in Hispaniola, but it is now known to occur in the Bahamas and southern Florida.

Neoclytus araeniformis Olivier, listed by Drs. Stahl and Gundlach, is dull purplish-brown in color, with characteristic whitish pubescent markings, 12.0 to 15.0 mm. long. The narrow elytra are spined at the apex, and the middle and posterior femora, greatly expanded and darkened, end in two spines, which are the more prominent because the beetle when alive normally rests with its tarsi and tibiae folded up beneath its body. Recorded also from Guadeloupe and Hispaniola, in Puerto Rico it has been found to date only in southwestern part of the Island: collections at Las Marías, Maricao, Añasco and Coamo Springs by Dr. Stuart T. Danforth apparently representing its extreme range. Adults have been reared from dead wood at Mayagüez and Yauco, and females have been observed

ovipositing in fresh logs of *Inga vera* at Indiera in the mountains between Yauco and Maricao, September 8, 1921. Logs of "ucar" (*Bucida buceras*), freshly-cut and being seasoned on the beach at Guayanilla, intended for use as the ribs of barges, were observed by Miguel A. Pérez and Luis F. Martorell as rendered quite unserviceable by the tunnels of the grubs of these beetles. The smaller larvae of *Cylindera flava* were boring between the bark and the wood of these logs, but those of *Neoclytus* were tunneling into the heartwood of the ucar.

Tilloclytus minutus was described by Mr. W. S. Fisher (1932–62) as "small, 4.8 mm. long, elongate, nearly glabrous and subopaque, above bluish-black, each elytron with a broad, transverse, white fascia at middle, connected posteriorly to a yellow vitta extending along the sutural margin to apex", the type from Tallaboa, collected by Mr. H. G. Barber on July 23, 1914. It has not been noted since.

Tilloclytus puertoricensis, one of the "New Cerambycid Beetles from Puerto Rico" (Jour. Agr. Univ. P. R., **19** (2): 51–63. Río Piedras, October 15, 1935) described by Mr. W. S. Fisher, is even smaller, 3.0 to 4.25 mm. long, with reddish elytra. The broad white transverse fascia on each elytron is bordered anteriorly with black, and an elongate black spot extends along the lateral margin nearly to the apex. The type and others were intercepted by Mr. R. G. Oakley in decaying wood in the Guánica Forest, October 3, 1934, but no additional collections have since been made.

Lamproclytus elegans was described by Mr. W. S. Fisher (1932–68) from a single female collected at Bayamón by Mr. R. C. Shannon, "3.8 mm. long, elongate, nearly parallel, strongly shining, black, except basal third of each elytron . . . brownish yellow, and each elytron ornamented with a transverse, eburneous fascia".

Lamproclytus oakleyi was described by Mr. W. S. Fisher (1935–52) from a single type intercepted by Mr. R. G. Oakley on *Tabebuia pallida* at Guánica, September 21, 1933. It is 3.25 mm. long, and differs from *L. elegans* in being uniformly dark reddish brown.

Rhopalophora pustulosa White, described from Venezuela, is reported from Puerto Rico.

Trachyderes nigripes Dupont, described from French Guiana, is doubtfully reported from Puerto Rico.

Neoptychodes trilineata Linnaeus, listed by Leng (1920–281) as a *Ptychodes* from Louisiana, Texas, Arizona and lower California, occurs also in Mexico, Central America, the northern part of South America, Trinidad, Puerto Rico, Jamaica and Cuba.

Monochamus titillator Fabricius, listed by Dr. Gundlach as a *Monohammus*, has not since been found in Puerto Rico.

What Dr. E. A. Schwarz determined as *Proecha spinipennis* Chevrolat

has been re-determined by Mr. W. S. Fisher as what he described (1926–3) from Cuba under the name **Ataxia alboscutellata**. It is elongate, subcylindrical, three-quarters of an inch or less in length, light brown in color with evenly scattered whitish pubescence, deeply punctured on elytra and pronotum, and may be distinguished by the ivory-white scutellum (whence the specific name *alboscutellata* given by Mr. Fisher), the segmentation of the antennae marked by whitish pubescence, and the three tubercles on the pronotum, one in front and one on each side. Puerto Rican specimens have been collected at Río Piedras, Pt. Cangrejos and Bayamón; by Dr. Stuart T. Danforth at Utuado, and by Mr. R. G. Oakley on dead wood at Guánica and on pomarrosa at Ponce. Among the "Insects and a Mite found on Cotton in Puerto Rico" (Bull. No. 39, P. R. Agr. Expt. Station, pp. 14, ref. 45. Washington, D. C., March 1939), Mr. L. Courtney Fife noted the larvae of this beetle boring in the stalks of cotton at Sabana Grande.

Ecyrus flavus was described by Mr. W. S. Fisher (1932–80) from a single female collected by Mr. R. H. Van Zwaluwenburg at Mayagüez, "elongate, 8.5 mm. long, robust, strongly convex above, uniformly pale reddish brown, rather densely clothed with short whitish and yellowish pubescence."

Ecyrus nanus was described by Mr. W. S. Fisher (1932–79) as "rather short, length 6.0 mm., robust, strongly convex above, uniformly reddish brown, densely clothed with whitish, brownish and yellowish pubescence": a single female collected by Mr. C. W. Leng at Boquerón, and another at Mayagüez by Mr. R. H. Van Zwaluwenburg. Dr. Donald De Leon found one of this genus on a rock beside a pile of old almácigo logs at Guánica. Both of these species are listed as *Callipogonius* by Mr. E. G. Linsley in his "Revision of the Pogonocherini of North America" (Ann. Ent. Soc. America, **28** (1): 73–103, pl. 1. Columbus, 1935).

Estola ignobilis Bates, a Central American Cerambycid, is listed from Puerto Rico, possibly in error for Costa Rica.

Oncideres lebasi, described by H. Dupont on p. 46 of his "Monographie des Trachydérides" (Guérin Magasin, Paris, 1936) from Puerto Rico, has not since been found.

Oncideres tessallata Thomson, of northern South America, is reported from Puerto Rico.

Cacostola leonensis Dillon & Dillon, described (Sci. Pub. No. 6, pp. 259–260, Reading Public Museum, Reading, 1946) from material collected at Coamo Springs by Dr. Stuart T. Danforth, is known only from the types.

Spalacopsis filum Klug, listed from Puerto Rico by Dr. Gundlach, and since found in a coffee grove at San Sebastián; by Dr. Stuart T. Danforth at Luquillo, and possibly this species on Malpighia flowers at Aibonito, is

an extremely slender and elongate beetle, with short, plump legs, which in life holds its antennae straight out in front of its head. By comparison with the slender antennae of Phasmids, it indicates how convergent development towards a similar end may find antennae useful, instead of an unavoidable nuisance and a deteriment to perfection of protective resemblance.

Oreodera glauca Linnaeus, found in Mexico, Central and the tropical parts of South America, is reported from many of the Lesser Antilles, and all of the Greater Antilles except Cuba.

Oreodera lateralis Olivier, described from Cuba, also occurs in Puerto Rico.

Steirastoma brevis Sulzer, found in most of South America and some of the Antilles, is reported from Puerto Rico.

Steirastoma histrionica White occurs in Mexico and Central America, in Jamaica and in Puerto Rico.

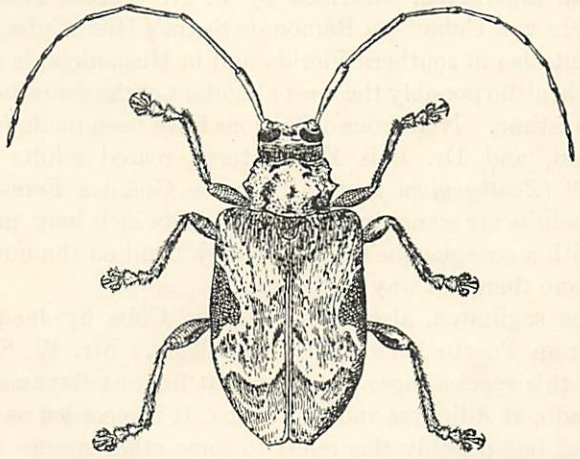
Acanthoderes circumflexa DuVal occurs in Mexico thru Central America to Venezuela, and in Cuba and Puerto Rico.

Lagochirus araeniformis Linnaeus is a somewhat flattened, robust, brownish Cerambycid, three-eights of an inch across at the humeral angles, and approximately twice as long, its antennae much longer than the body, which is marked with intricate wavy pattern of grey and lighter brown. Listed by Drs. Gundlach and Stahl, it is common in all the less elevated parts of Puerto Rico, and elsewhere occurs thruout tropical America from Mexico to Argentina, in all the Greater Antilles and in many of the Lesser, but has not been collected on Vieques, Culebra, Mona or Desecheo.

Despite the wide distribution of the species and the abundance of its squeaking adults, apparently nothing was known of the immature stages until Dr. Willis R. Whitney, founder and for many years in charge of the research division of General Electric Co., in February 1940, "while tramping along the West Bay Road, leading from Nassau, Bahamas, to the Golf Club, found a tree which had very peculiar, large holes through its bark. They were approximately round and varied from about one and a half to two inches in diameter. Over most of these holes were still attached the bark coverings nearly quarter of an inch thick. These reminded one of refrigerator doors, owing to their well-fitted, beveled edges. Automatically, we at once spoke of these as "trap-doors"." Of Dr. Whitney's most persistent search for the cause of these "trap-doors" in the bark of what in the Bahamas is locally known as "gumbo limbo" or "gum eleme," or more generally referred to as West Indian birch: the "almácigo" of Puerto Rico, *Bursera* (*Elaphrium*) *simaruba* (= *B. gummifera*), may be read in his privately printed "Isn't Research Fun" (Schenectady, N. Y., August 1941, and subsequently reprinted in the Caribbean Forester, **3** (2): 47–56, pl. 1.

Río Piedras, January 1942, and summarized in Entomological News, **53** (3): 60–62, pl. 1, ref. 5. Philadelphia, March 1942 by Dr. Raimon L. Beard as "A Note on *Lagochirus araeniformis* L.").

In part of a dead almácigo tree with similar cavities and "trap-doors" brought to the laboratory from Camuy on May 21, 1941, larvae and pupae were found, the chirping of the first adult signalizing its emergence on the 26th. Altho fully-grown larvae occurred in the cavities under the bark where they had completed their growth, they retired to the interior of the log for pupation. "In the quiet of the laboratory, one can hear the larva chewing just beneath the bark, and note exactly its location. But a day or two later, the "trap-door" begins to crack loose, and nothing is present



The Cerambycid Beetle, *Lagochirus araeniformis* Linnaeus, twice natural size. (Drawn by Fritz Maximilien.)

in the deserted chamber except the hole back into the center of the log where pupation will occur. The intriguing chamber is only a feeding cavity and nothing more."

The considerably smaller but quite similar *Lagochirus obsoletus* Thomas, which does not occur in Puerto Rico, was found by Mr. Patricio Cardin to be one of the most injurious of the "Insectos y Enfermedades de la Yuca en Cuba" (Bol. No. 20, Est. Expt. Agr., pp. 28, pl. 8. Santiago de las Vegas, 1911), several larvae often developing in a single shoot. His photographs indicate a comparable feeding of the nearly fully-grown larvae in the tissue just under the bark and "cuando ha llegado á su completo crecimiento la larva hace un agujero hasta llegar casi afuera para poder salir cuando adulto, forma su cámara con serrín y virutas arriba y abajo de él, con la cabeza hacia la salida y empieza á pasar sus metamórfosis". It is

possible that the bark of the manioc also cracks around the area where the larva has been feeding, but even the largest shoots are too small to develop the "trap-doors" which Dr. Whitney describes in the bark of the gumbo limbo.

Oviposition by the females of *Lagochirus araeniformis* does not occur in the living, uninjured tree, nor in dead, decaying logs on the ground, but in freshly-cut logs or branches, and the hatching larvae may develop to adult even in those which, when used for fence posts, take root and live. From the almácigo material brought from Camuy, adults of the predaceous Elaterid, *Chalcolepidius silbermanni* Chevrolat, later emerged, their larvae having fed upon the larvae and developed in the tunnels of the Cerambycid.

Leptostylus argentatus, described by P. N. Camille Jacquelin-Duval in "Coleoptera von Cuba" (*in* Ramón de Sagra's Hist. Cuba, VII, p. 273. 1857), present also in southern Florida and in Hispaniola, is not listed by Dr. Gundlach, altho possibly the most abundant of the genus in Puerto Rico at the present time. Numerous collections have been made from all parts of the Island, and Dr. Luis F. Martorell reared adults from pieces of "aceitillo" (*Zenthoxylum flavum*) from the Guánica Forest in October 1938. The adults are somewhat less than half an inch long, mostly grey in color, but with a conspicuous transverse dark band on the inner margin of the elytra more than half way to the apex.

Leptostylus sagittatus, also described from Cuba by Jacquelin-Duval, was listed from Puerto Rico by Dr. Gundlach. Mr. W. S. Fisher has identified as this species those intercepted at light at Bayamón, on grapefruit at Dorado, at Adjuntas and at Villalba. It is recorded as eaten by the crested lizard, but possibly this refers to some other species of the genus.

Of the nine species of *Leptostylus* which occur in Puerto Rico, all except the two just discussed have been described by Mr. W. S. Fisher from specimens collected within little more than the last score of years, and this is by no means all that may be present. Many of the species are small to of medium size, usually robust, mottled grey or brown, with exceptionally long antennae. Dr. Alex. Wetmore found that they had been eaten by the following birds: cuckoo, woodpecker, tody, owl, flycatcher, honey creeper, redstart and several vireos and warblers.

Leptostylus longicornis, so named by Mr. W. S. Fisher (Proc. U. S. National Museum, **68** (2623) Art. 22: 1–40. Washington, D. C., 1926) because of its extremely long antennae, was described from a single male, 11.5 mm. long, 4.5 mm. wide, bearing the label "Porto Rico Exp. Sta." (which is the Station at Mayagüez, not that at Río Piedras, as inferred by Mr. Fisher). Subsequent identifications by Mr. Fisher, in addition to an undersized adult from Aibonito, are: at light at Mayagüez, on dead wood at Adjuntas, resting on bark of *Inga vera* at Lares, on firewood at Lares,

and in tunnels of a log at Naguabo. These are "uniformly reddish-brown, densely clothed with cinereous pubescence," most obviously marked with a denuded median darker area on the pronotum opposite the dark scutellum, the pubescence being considerably lighter in the specimens from Naguabo.

Leptostylus antillarum, one of the "New West Indian Cerambycidae (Coleoptera), Subfamily Lamilinae" described by Mr. W. S. Fisher (American Museum Novitates No. 174, pp. 16. New York, May 28, 1925) from types and paratypes collected by Mr. August Busck on Culebra Island in February 1899, and one collected on cacao at Mayagüez by Dr. C. W. Hooker, is "strongly robust and moderately convex above, length 11.0–12.0 mm., width 5.0–5.2 mm., uniformly reddish brown to brownish black, rather densely clothed with pale brownish pubescence, and ornated with a few darker and paler areas." Subsequent collections of adults have been made at light at Bayamón, on *Derris eliptica* at Río Piedras, on dead wood at Yauco, all identified by Mr. Fisher, as well as adults reared from larvae under bark of stump at Dorado, and larvae and pupae in rotten fence post at Maricao.

Leptostylus albosignatus Fisher (1935–53), the type from Ponce, the paratype from Bayamón, is "allied to *antillarum* Fisher, but differs from that species in having a distinct, large, white pubescent spot on the elytra."

The type of **Leptostylus gundlachi** Fisher (1925–2), only 6.0 mm. long, 2.75 mm. wide, "reddish brown, not very densely clothed with brownish-white pubescence, with an obsolete opalescent tinge and a few dark brown areas," was from Aibonito. An adult, identified by Mr. Fisher, has been reared from a pod of *Erythrina glauca* at Río Piedras.

Leptostylus oakleyi, another small species, 4.5 mm. long, 1.8 mm. wide, described by Mr. W. S. Fisher (1935–54) from a single specimen collected at light at Bayamón, "is allied to *gundlachi* Fisher, but differs in the arrangement of the brown pubescence on the elytra, and in having a broad, dark brown, pubescent vitta on each side of the pronotum." Others had previously been taken at light at Río Piedras, as subsequently identified by Mr. Fisher.

Leptostylus nigricans, described by Mr. W. S. Fisher (1935–55) from a single type collected by Mr. R. G. Oakley at Villalba, is even smaller, 4.0 mm. long, 1.75 mm. wide, "elongate, moderately flattened above, brownish yellow, with the basal halves of elytra, disc of pronotum, tips of antennal joints, tarsi, and parts of the head, tibiae and femora, black or dark brown and rather densely pubescent".

Leptostylus puertoricensis, 4.0 mm. long, 1.75 mm. wide, described by Mr. W. S. Fisher from a single specimen collected by Mr. R. G. Oakley at Adjuntas, is "elongate, moderately flattened above, brownish black to brownish yellow, rather densely pubescent."

Trypanidius nocturnus, described by Mr. W. S. Fisher (Jour. Agr. Univ. P. R., **25** (4): 38. Río Piedras, April 7, 1942) from a single female collected by Dr. Luis F. Martorell at Villalba, May 18, 1940, is "broadly elongate, uniformly dark reddish-brown, length 15.0 mm., each elytron ornamented with a black pubescent spot along sutural margin behind scutellum and a narrow arcuate one behind middle, the apical fourth yellowish-white, tip obtusely angulated; pronotum with short acute tubercle on each side behind middle."

Lepturges guadeloupensis Fleutiaux & Sallé, in size comparable to the smallest of the *Leptostylus*, occurs in several of the Lesser Antilles, as well as in Cuba and Puerto Rico. Dr. Alex. Wetmore records it eaten by the tody, and it also serves as an item of food for the crested lizard. Dr. W. A. Hoffman found adults inside dead branches of "flamboyán" (*Delonix regia*) in the patio of the School of Tropical Medicine, and they have been noted burrowing inside hibiscus twigs at Mayagüez; in "mangle" (*Rhizophora mangle*) at Loíza; in "burro" (*Capparis flexuosa*) at Santa Isabel; as well as resting on dead wood and on orange tree at Ponce; in coffee groves at Ciales and Villalba, and resting on cotton at Guayanilla. From a larva found inside a pod of "aroma" (*Acacia farnesiana*) at Boquerón on April 24, 1923, an adult was reared: possibly indicating the normal, but more probably an atypical host for the immature stages.

Probatius umbraticus J. DuVal, found in southern Florida and Cuba, was listed from Puerto Rico by Dr. Gundlach, and has since been collected by Mr. R. G. Oakley at Ponce on "moca" (*Andira jamaicensis*).

Eugamandus oakleyi was described by Mr. W. S. Fisher (1935–57) from a single specimen collected by Mr. R. G. Oakley in decaying wood at Matrullas Dam, near Orocovis. It is 5.75 mm. long, 3.0 mm. wide, "short, oblong, strongly convex, subopaque, uniformly reddish or yellowish brown, each elytron ornamented laterally with an irregular, black pubescent vitta."

Eugamandus brunneus was described by Mr. W. S. Fisher (1935–58) from material collected by Mr. R. G. Oakley from vegetable debris at Indiera in the mountains north of Yauco, being "very closely allied to *oakleyi* Fisher, but much smaller and more slender, and differs in having tubercles on each elytron arranged in two longitudinal rows".

Eugamandus flavipes Fisher (1935–58), collected by Mr. R. G. Oakley at Villalba, also "is allied to *oakleyi* Fisher, but differs in having the elytra evenly convex, arcuately declivous posteriorly, and each elytron armed with only two distinct tubercles".

Cyrtinus eugeniae, described by Mr. W. S. Fisher (1935–60) from material collected by Mr. R. G. Oakley at Aibonito on "pomarrosa" (*Eugenia jambos*), is only 2.0 mm. long, 0.63 mm. wide, "elongate, feebly shining;

head, pronotum and abdomen dark reddish brown; antennae, legs and elytra slightly paler, the latter dark reddish brown along lateral margins".

Cyrtinus oakleyi, described by Mr. W. S. Fisher (1935–62), who named it for the Plant Quarantine Inspector who intercepted it at Indiera, in the mountains north of Yauco, is only 1.75 mm. long, 0.6 mm. wide, being "allied to *eugeniae* Fisher, but differs in being strongly shining, in having the pronotum as wide as long, and each elytron ornamented with two reddish brown spots".

Cyrtinus subopacus Fisher (1935–61), of which the type is from Adjuntas, is 2.5 mm. long and 0.75 mm. wide, "allied to *eugeniae* Fisher, but differs in being larger and subopaque, and in having the punctures on the elytra elongate".

Chrysomelidae: Leaf Beetles

Chrysomela, the type genus of the Chrysomelidae, is derived from two Greek words meaning "gold" and "fruit." Only a few of the species found in Puerto Rico are golden, but many are iridescent or brightly colored. **Lema dorsalis** Olivier, for instance, has a shining orange pronotum, broad diagonal and transverse bands of yellow on deeply punctured purplish-blue elytra, dark orange head, black eyes and antennae, and blue-black legs. Slender and usually less than 5.0 mm. long, in size and brightness of coloration it is typical of the family. A widely distributed species, with a range including Mexico, Central and northern South America and most of the Antilles, it is especially abundant in the western part of Puerto Rico, notably around Mayagüez, where it was first collected by Dr. Gundlach.

Lema nigripes, described from Puerto Rican material collected by Dr. Gundlach, by Herr Julius Weise in his "Beitrag zur Chrysomeliden— und Coccinelliden—Fauna Portorico's" (Archiv fur Naturgechichte, **51** (1): 144–168, pl. 8. Berlin, 1885), and not since found elsewhere, has not only black legs, but also black antennae and eyes, an orange yellow body and dark blue elytra. Since Dr. Gundlach's collection of the type, it has been found in many localities in the more humid parts of the Island. Dr. Stuart T. Danforth found it eaten by Adelaide's warbler, and it has been noted in the stomach of the crested lizard. Dr. Alex. Wetmore found beetles of this genus eaten by the ani, tody, wood pewee, black and white warbler and the honey creeper. Nothing is known of the immature stages of these beetles, or even of the preferred host plants eaten by the adults, for most have been swept from grass or weeds, or collected resting on crotalaria flowers, or on foliage of cocozelle squash or commelina.

Lema polita, described from Puerto Rico by J. T. Lacordaire in his "Monographie des Coleopteres Subpentameres de la Famille des Phyto-

phages, Vol. 1" (Mem. Soc. Royal Sci. Liege, **3:** 355. Liege, 1845), and not since found elsewhere, is entirely black except for blue elytra. Recent collections have been made at Río Piedras and at Bayamón. Dr. Stahl lists this species as *Lema placida* Lacordaire, and also lists from Puerto Rico *Lema poeyi*, which Lacordaire had described from Cuba, and *Lema confusa* Chevrolat, neither of which has since been found here.

Pachybrachis mendica Weise (1885–153), endemic in Puerto Rico, where it was first collected by Dr. Gundlach, has since been found on Mona Island by Prof. J. A. Ramos. Dr. Stuart T. Danforth found it on acacia at Guánica and Tallaboa, and Mr. R. G. Oakley on *Randia mitis* at Ponce. Other specimens collected by Mr. Oakley on mangrove at Ponce and Guánica were thought by Mr. H. S. Barber to be a new species of *Pachybrachis*.

Pachybrachis praetextata, an endemic species described by C. G. L. Eduard Suffrian, "Zur Kentniss der Nordamerikanischen Cryptocephalen" (Linnaea **6:** 282–3 & **7:** 203. 1852) has not since been noted in Puerto Rico.

Cryptocephalus, meaning "concealed head," is the name given to those Chrysomelid beetles which have "the head so deeply immersed in the strongly convex thorax that it can be scarcely or not at all seen when viewed from above."

Cryptocephalus nigrocinctus, described by Suffrian (1852(**6**)–282), an endemic species found only here, is by far the most abundant of the genus locally: almost entirely blue-green to dull purplish brown in color. *Cryptocephalus tristiculus* Weise (1885–147) is apparently the same species, not since reported from outside of Puerto Rico. Individuals vary greatly in size, smoothness of punctation of thorax, the size and distinctness of the pale mark on the central portion of the basal segment of the abdomen, and in general color; most of the females being blue-green and most of the males dull purplish-brown, but with no sharp distinction between intergrading forms. In thirty specimens collected from the leaves and terminal shoots of mangrove (*Rhizophora mangle*, *Laguncularia racemosa* and *Conocarpus erecta*) on the shores of Laguna San José, near Río Piedras, July 4, 1923, all combinations and variations were noted, as detailed in "Insectae Portoricensis" (1923–112). Two of these individuals showed traces of the yellow spots from which Herr Weise may have derived his name *tristiculus*, and one collected December 8, 1939 in a cane field at Fajardo distinctly shows six yellow spots margining the prothorax and three on each elytron. Dr. Gundlach lists both names, and Mr. H. S. Barber identifies most specimens submitted as **C. tristiculus**. Despite the abundance of the adults, nothing is known locally of the immature stages. The adults have been found generally in the more humid portions of the Island, from the coast to

the interior valleys, but not in the mountains, and only rarely on the xerophytic south coast. They feed on the leaves, and sometimes on the flowers, of a great variety of host plants, mostly weeds of no value, or trees, and only incidentally on economic crops. Indeed, altho one might consider that their morphological variations are matched by the non-selectivity of their host preferences; when found on one plant, rarely are they also feeding on near-by alternate hosts. The list of those on which they have been observed feeding includes the flowers of mango at Mayagüez, of *Inga laurina* at Yauco, and of the wild marguerite (*Bidens pilosa*) at Cidra; and the leaves of orange at Arecibo and Adjuntas, of grapefruit at Río Piedras, Vega Baja and Mayagüez, of cotton at Arecibo, Aibonito, Algarrobo and Quebradillas, of pepper at Ponce, of cassava at Lares, of roses at Río Piedras and Aibonito, of tobacco at Cayey, of "fresas" (*Rubus rosaefolius*) at Cayey, of *Stigmaphyllom tomentosusm* at Ciales, of "jagüey" (*Ficus stahlii*) at Ponce, of "guano" (*Ochroma pyramidale*) at Cayey, of eucalyptus at Mayagüez, of seagrape (*Coccoloba uvifera*) at Humacao Playa, of "capá cimarrón" (*Cordia borinquensis*) at Camuy, of "sauce" or Humboldt's willow (*Salix chilensis*) at Florida, of *Psidium guajava* at Juncos and Cayey, of *Dalbergia hecastophyllum* at Humacao, Algarrobo and Tortuguero, of "icaco", (*Chrysobalanus icaco*) at Pt. Salinas, of *Inga laurina* at Lares, of *Inga vera* at Mayagüez and Río Piedras, of "almendro" (*Terminalia catappa*) at Arecibo. It may be presumed that many other native and introduced plants may also at times serve as food for the adults.

Because of the abundance of these beetles, they are eaten by all the species of arboreal lizards, and even by the local iguana, *Ameiva exsul*. Dr. Stuart T. Danforth reports finding them eaten by the black-throated blue and the northern parula warblers, and Dr. Alex. Wetmore noted that some species of *Cryptocephalus* were eaten by five species of warblers, the redstart, vireos and also by the oriole, martin, swallow, wood pewee, flycatcher, petchary, kingbird and tody. Quite aside from the intrinsic beauty of these quaint little sculptured Chrysomelids, they might be considered esthetically valuable because to such a large extent they serve as food for vireos and warblers.

Cryptocephalus perspicax Weise (1885–151), an endemic species not found outside of Puerto Rico, is bright yellow in color, the light brown prothorax and elytra usually having large, but sometimes small, yellow spots. It is not nearly so abundant as the blue-green species, but adults are to be found feeding on much the same plants, altho not at the same time or at the same locality. Dr. E. A. Schwarz determined those from Quebradillas feeding on the leaves of seagrape (*Coccoloba uvifera*), later confirmed by Mr. A. J. Mutchler, and subsequent records are on leaves of *Inga vera* at Río Piedras; on *Inga laurina* at Mayagüez, Ponce, Aibonito

and Comerio; on *Dalbergia hecastophyllum* at Pt. Salinas; on *Myrcia* sp. at Ciales; on "moca" (*Andira jamaicensis*) at Mameyes; on *Solanum torvum* at Río Piedras. Adults have been found in the stomachs of the lizards *Anolis stratulus* and *Anolis gundlachi*, and presumably they are eaten by vireos, warblers and other small insectivorous birds.

Cryptocephalus stolidus Weise (1885–149), as identified by Mr. A. J. Mutchler, has bright yellow elytra of which only the punctures are brown, or, to quote Weise's description, "elytris profundo punctatostriatis." Adults have been collected on the leaves of *Solanum torvum* at Ciales, Mr. R. G. Oakley found it on *Ficus* at Ponce, and Dr. Stuart T. Danforth had specimens from Guánica and Aibonito. It occurs only in Puerto Rico. As illustrated by Weise, the above two species seem quite distinct, but in an extensive collection from various localities and hosts, all sorts of gradations occur, some beetles being almost entirely brown with very small yellow spots, while others are almost entirely yellow. Of the eight specimens which Mr. Thos. H. Jones collected on *Inga vera* at Comerio, showing the maximum variation, which he thought might represent "perhaps two species mixed," the presence of intermediates presumably indicates that all are the same species.

Cryptocephalus multiguttatus Suffrian, of which specimens as determined by Mr. H. S. Barber were collected by Dr. Stuart T. Danforth at Faro de Cabo Rojo, and of which numerous specimens were found by Prof. J. A. Ramos on Mona Island, also occurs in Hispaniola. By Weise it is compared with his "rufobrunneus" **Cryptocephalus krugi** (1885–148), which has 22 spots on the two elytra. Previously known only from Puerto Rico, Prof. J. A. Ramos has specimens determined as "near" this species from Mona Island. Dr. Stuart T. Danforth had specimens from Ponce, Yauco and Mayagüez, and reports (1931–87) it eaten by the Jamaican vireo.

Cryptocephalus tortuosus Suffrian, a Cuban species, is listed by Herr Weise from Puerto Rico without comment, and Dr. Gundlach has this record, and also that of **Cryptocephalus polygrammus** Suffrian (1852–85), of which the type is from Puerto Rico. Leng & Mutchler (1917–210) list the Cuban and Jamaican **Cryptocephalus viridipennis** Suffrian. Specimens to which these names might be applied have not since been found in Puerto Rico, altho numerous individuals have been intercepted by Mr. R. G. Oakley in southern Puerto Rico to which specific names were not assigned by Mr. H. S. Barber.

Diachus nothus, described by Weise (1885–152) as a *Cryptocephalus*, is much smaller than any of the previous species, and can be readily distinguished by its bright yellow pronotum and iridescent blue elytra. Dr. Gundlach lists it, and notes, "no en Cuba, donde vive *C. pusio* Suffrian,

que es muy parecido". As *Cryptocephalus pusio*, Dr. Alex. Wetmore reports it eaten by the tody, elainea, cliff swallow, parula warbler and honey creeper, but none was found in the stomach contents of any of the lizards examined. Mr. H. S. Barber noted the occurrence of smaller, non-typical varieties from Puerto Rico which have black elytra, but yellow head and legs, while the smallest ones are entirely black or piceous. Like the the larger *Cryptocephalus*, these smaller and brighter or darker beetles also feed on the leaves of *Inga vera* and *Inga laurina* in the coffee groves of the mountains or on grapefruit foliage in the groves along the coast, and Mr. R. G. Oakley found them on the flowers of "pomarrosa" (*Eugenia jambos*) at Aibonito.

Triachus cerinus LeConte, described from Florida, is among the smallest of the Chrysomelids. According to the identification by Mr. H. S. Barber, it was found by Mr. R. G. Oakley on the flowers of *Randia mitis* at Ponce.

Chlamisus straminea Suffrian, described originally from Cuba, was first recorded from Puerto Rico as a species of *Chlamys* found by Dr. Alex. Wetmore in the stomach contents of the northern parula warbler. Later, specimens were collected by Mr. R. G. Oakley at Ponce on *Dioscorea* and *Ocotea*, and on flowers of "pomarrosa" (*Eugenia jambos*) at Aibonito. The flowers of pomarrosa at Aibonito also harbored other small Chrysomelids identified by Mr. H. S. Barber as species of **Exema.**

Lamprosoma longifrons Lacordaire, listed from Puerto Rico by Weise (1885–154) and by Dr. Gundlach, has subsequently been collected by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*) in the mountains back of Ponce, and on undetermined host at Indiera, in the mountains back of Yauco.

Nodonota wolcotti a bronze-black beetle, shining, finely and evenly punctured, each puncture with a short white hair; antennae, tibiae and tarsi brown, was described by Mr. G. E. Bryant in his "New Species of Phytophaga" (Ann. & Mag. Nat. Hist., **13** (9): 299. London, March 1924) from material taken on sagebrush or wild croton at Aguadilla. It is a conspicuous and relatively common insect of "yerba bellaca" (*Croton humilis*), not only in the more xerophytic parts of Puerto Rico but also on Mona Island. One individual has been found hiding in an Attelabid egg-roll of seagrape (*Coccoloba uvifera*) at Mameyes, and others intercepted at Luquillo on the beach. It has also been intercepted on "mabí" (*Colubrina reclinata*) at Mayagüez, and by Mr. R. G. Oakley at Guánica, and on cotton flowers and wild morning glory at Ponce.

Colaspis alcyonea Suffrian, a Cuban species listed by Weise (1885–155) and Dr. Gundlach from Puerto Rico, is represented in subsequent collection by a single specimen taken by Mr. Thos. H. Jones on weeds in a clearing on El Yunque, identified by Dr. E. A. Schwarz as probably this

species. It is an elongate brownish beetle with light greenish iridescence most marked on pronotum and head.

Alethaxius puertoricensis, described by Mrs. Doris Blake (Jour. Washington Acad. Sci., **35** (10): 327. Washington, D. C., 1945) from material from El Yunque, is a small, pale yellow-brown Chrysomelid, of which the males are "without the elytral warts and rugosities" characterizing the females.

The male of **Alethaxius yunquensis,** one of "Seven New Species of West Indian Chrysomelidae (Coleoptera)" (Proc. Ent. Soc. Washington, **48** (5): 111–119, pl. 1. Washington, D. C., June 21, 1946) described by Mrs. Blake from males collected by Dr. P. J. Darlington, is "4.0 mm. in length, oblong, shining cupreous with greenish lustre above" and is characterized by the uneven depressions on the pronotum.

The female of **Alethaxius semicostatus** Blake (1946–118) "is by far the largest species yet known from the West Indies", being "6.0 mm. in length, oblong, shining cupreous, prothorax uneven and with toothed margin".

Alethaxius meliae "also occurs in Puerto Rico", according to Mrs. Blake (1946–119).

Metachroma antennalis, a shining brown endemic Chrysomelid of Puerto Rico, described by Weise (1855–155) as "rufo-testacea", 3.3 mm. long, was found by Dr. Alex. Wetmore in the stomach contents of the oriole and several warblers. At times, this beetle may become very abundant, and outbreaks of adults have been reported attacking cotton at Quebradillas in June 1922, and the foliage of rose bushes at Aguirre in 1932. When less numerous, they have been found hiding during the daytime in the bracts of the squares and bolls of cotton, in spider nests or in the curled-up leaves of various plants. They are attracted to light at night, sometimes in large numbers. All the records of occurrence are in the western part of the Island: Arecibo, Hatillo, Guajataca, Aguadilla, Guánica Lagoon, Ponce, Coamo and Aguirre, and apparently this species is not found high in the mountains or in eastern Puerto Rico.

The Cuban **Metachroma liturata** Suffrian was first reported from Puerto Rico by Dr. Alex. Wetmore as forming an item of the food of the oriole, and later Mr. H. S. Barber identified as this species the beetles collected by Mr. R. G. Oakley on "ucar" (*Bucida buceras*) at Juana Díaz.

The Hispaniolan **Metachroma wolcotti** Bryant, as identified by Mr. H. S. Barber, was also found on "ucar" (*Bucida buceras*) at the same time and locality that the Cuban species of this genus was collected by Mr. Oakley. To numerous other beetles of this genus intercepted in coffee groves in the mountains, and on guava bushes at Bayamón, Aibonito and Villalba, and on various other hosts in the higher mountains, Mr. Barber assigns no specific name, considering them to represent one or more new species.

To the Puerto Rican representative of "The Species of **Myochrous** from the West Indies (Coleoptera)" (Proc. Ent. Soc. Washington, **49** (1): 22–28, pl. 1. Washington, D. C., January 15, 1947) Mrs. Doris Blake assigns the name **portoricensis.** It is 5.0 to 6.0 mm. in length, "oblong, piceous, covered with grayish yellow, closely appressed scales, the thorax with three teeth along the side, not so deeply punctate", the type having been collected in February 1899 at Arroyo by Mr. August Busck. Specimens found in the stomach of the killdeer at Guánica Lagoon in May 1912 by Dr. Alex. Wetmore are also cited by her, and it may be presumed that others listed by Dr. Wetmore, eaten by the ani, woodpecker, flycatcher, cliff swallow, honey creeper, vireos and warblers, are of this species, which apparently was exceptionally abundant at the time of his investigation on the food of "The Birds of Porto Rico". The specimens later swept from swamp vegetation at Boquerón, identified by Mr. G. E. Bryant as *Myochrous armatus* Baly, agree with Mrs. Blake's description of *portoricensis*, and presumably indicate that but a single species occurs in Puerto Rico. All records are of occurrence on the south side of the Island: by Dr. P. J. Darlington and Prof. J. A. Ramos at Guánica Lagoon, and by Dr. Luis F. Martorell, resting on cane leaf at Salinas.

Leucocera laevicollis Weise (1885–156) is a large, plump, iridescent blue Chrysomelid, "nigro-violacea, subtus interdum cyanea, long 6.0 mm.", according to the original description of specimens which presumably Dr. Gundlach had collected at Mayagüez. The next record is from near Río Piedras, where in December 1922 these beetles were found on *Malpighia coccigera* in the Seboruco woods, opposite the Isle of the Caves, Laguna San José, and again on the same host and at the same locality in June 1923. In September 1936, Prof. J. A. Ramos made extensive collections at Mayaguez, the species subsequently becoming so abundant on its specific host as to be discussed in the 1939 report of the Mayagüez (Federal) Agricultural Experiment Station (1940–116), as follows:

"In April numerous bright steel-blue beetles about 7 millimeters long were noted feeding on the young leaves of the native red cherry, cereza colorada (*Malpighia punicifolia* L.) at Mayagüez. The feeding of both the larvae and the adults of this insect prevented the normal leafing of five small trees that were being used for ornamental purposes on the station grounds. Towards the latter part of May, or about 6 weeks after injury became conspicuous, practically all the leaves had been consumed and the bark of the twigs up to slightly more than three-fourths of an inch in diameter were being fed upon. So extensive and severe was the subsequent feeding that the trees were kept leafless, one of the trees died, and most of the remaining trees were being killed by girdling".

Phaedon sp. is the identification by Mr. H. S. Barber of beetles intercepted by Mr. R. G. Oakley at Indiera at Km. 22 on the Yauco-Lares road.

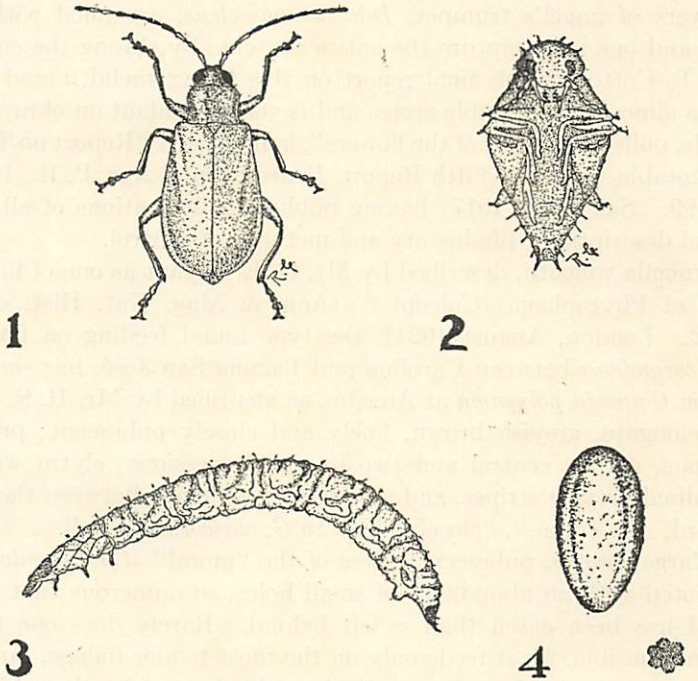
Of the very numerous species of *Diabrotica* which occur in the neotropics, Puerto Rico actually has less than half of the few listed. *Diabrotica aeruginea* Fabricius has not been collected here since the original record from Puerto Rico. The record of the Costa Rican *Diabrotica dorsoplagiata* Jacoby in Puerto Rico is apparently due to the confusion of names of the two countries. Dr. Stahl's name of *Diabrotica thoracica* Fabricius is in synonymy with *Diabrotica quadriguttata* Olivier, listed by Weise and Dr. Gundlach, but no specimen to which these names might be applied has since been found here. *Diabrotica impresa* suffrian has not been collected recently.

Diabrotica annulata Suffrian, as identified by Mr. H. S. Barber, has been intercepted on squash at Barceloneta and on wild cucumber at Villalba, but it is by no means abundant, or tending to become a pest of cultivated curcurbits.

Diabrotica bivittata Fabricius and **Diabrotica innuba** Fabricius are common economic species, each having a black head, shining bright orange-red prothorax, closely and densely punctured yellow elytra, black on the central margin and in a broad median band, so that Fabricius' name of *bivittata* (two-banded) applies equally well to either species. The larger is *innuba*, of which the "legs are partly black, elytral apices dentate"; the smaller *bivittata* has "legs entirely testaceous, elytral apices not dentate", to quote from Dr. E. A. Schwarz, veteran systematic and economic coleopterist. These are specifically pests on curcurbitaceous plants, having been repeatedly collected on cucumbers, melon, squash, pumpkin, canteloupe, watermelon, Chinese cabbage and wild cucumber in all the more humid parts of the Island, feeding chiefly on the flowers, of which they are exceptionally fond, but more rarely eating the tender young leaves. By accident, they may be sometimes found resting on other vegetation. Both are listed by Drs. Stahl and Gundlach, and by Weise, giving *Diabrotica pallipes* Olivier in synonymy with *D. bivittata*. Leng & Mutchler record *D. innuba* from Culebra Island. Mr. R. H. Van Zwaluwenbug noted the occurrence of both species on beans as well as on curcurbits, Mr. W. V. Tower conducted preliminary tests in control by spraying with Bordeaux and arsenate of lead, while Mr. D. W. May, Director of the Mayagüez Station, mentions them as being eaten by the newly introduced Surinam toad, *Bufo marinus*. At Río Piedras, Mr. Thos. H. Jones had noted their preference for flowers, but the first intensive life-history studies were made by Dr. Richard T. Cotton as presented in his paper on the "Insects Attacking Vegetables in Porto Rico" (Jour. Dept. Agr. P. R., **2** (4): 265–317, illus. San Juan, October 1918). "The beetles lay their small yellow eggs in the soil around the roots of plants, and the larvae,

which are slender, white, worm-like creatures, feed on and tunnel in the roots".

The light bluish-green **Diabrotica graminea,** possibly thus named by Mr. J. S. Baly in his "Descriptions of Uncharacterized Species of *Diabrotica*" (Trans. Ent. Soc. London, **4:** 443. London, December 1886) because of its grass-like color, occurs only in Puerto Rico and on Vieques Island. Undescribed at the time that Dr. Gundlach was here, it surely must have been collected by him, and possibly is what he and Weise list



Diabrotica graminea Baly: 1, adult, 2, pupa, 3, fully-grown larva, all about five times natural size; 4, egg, very greatly enlarged, with detail of sculpturing below. (Drawn by R. T. Cotton.)

as *Diabrotica quadriguttata* Olivier, and Dr. Stahl as *Diabrotica thoracica* Fabricius. Leng & Mutchler list it from Vieques Island, and Dr. C. W. Hooker considered it most "abundant on the south side of Porto Rico". Admittedly it may not be as common at Mayagüez as elsewhere, Dr. Stuart T. Danforth having few specimens from the immediate environs of the "Sultana del Oeste", but distribution seems to be quite general thruout the Island. Dr. Alex. Wetmore found this beetle to have been eaten by the ani, tody, petchary and grasshopper sparrow, but we have no record of

its being eaten by the introduced toad, or any of the endemic lizards. As to hosts, Mr. R. H. Van Zwaluwenburg mentions beans, squash, sugar-cane and bucare, and both Mr. D. L. Van Dine and Mr. E. G. Smyth note its occurrence on sugar-cane. Mr. Thos. H. Jones also found it "very common on leaves of sugar-cane, but with injury most severe on corn and okra, on flowers of cowpeas and to the foliage of *Spondias lutea* and *Amaranthus spinosus*". Other plants on which it has been noted in abundance are: tomatoes, eggplant, wild eggplant, pepper, potato, peas, pigeon peas, cundeamor, crotalaria, lima bean, soybeans and orange. At times, the flowers of angel's trumpet, *Datura suaveolens*, are filled with these beetles, and one may capture the entire contents by closing the entrance. Dr. R. T. Cotton, in his final report on this Chrysomelid, noted that it "attacks almost all vegetable crops, and is very abundant on okra, feeding on petals, pollen and pistil of the flowers", in his earlier "Report on Tobacco and Vegetable Insects" (Fifth Report, Board Comm. Agr. P. R., 1915–16, pp. 86–99. San Juan, 1917) having published illustrations of all stages, technical descriptions, life-history and methods of control.

Galerucella wolcotti, described by Mr. G. E. Bryant as one of his "New Species of Phytophaga (Coleopt.)" (Ann. & Mag. Nat. Hist., **14** (9): 247–252. London, August 1924), the type found feeding on flowers of *Cordia corymbosa* between Carolina and Laguna San José, has since been found on *Gouania polygama* at Arecibo, as identified by Mr. H. S. Barber. It is "elongate, greyish brown, finely and closely pubescent; prothorax testaceous, with a central and two lateral depressions; elytra with four longitudinal greyish stripes, and a feble greyish stripe between the second and third. L. 4 mm.", "closely allied to *G. varicornis* Wse.".

The large, coarse, pubescent leaves of the "moral" (*Cordia sulcata*) are often noted with an abundance of small holes, so numerous that more of the leaf has been eaten than is left behind. Rarely does one find the insect responsible, for it feeds only on the most tender foliage, but collections were made at Mayagüez in 1923 on this host of beetles which were determined by Dr. E. A. Schwarz as **Galerucella varicornis** Weise (1885–157), presumably described from material collected at Mayagüez by Dr. Gundlach. Prof. J. A. Ramos has made additional collections since at Mayagüez, but the insect is not confined to the Mayagüez region, as specimens have been found at Ponce, Villalba and El Verde (Río Grande).

Galerucella obliterata, described by A. G. Olivier in his "Entomologié 6" (**93:** 635. Paris, 1808), is a third endemic species of this genus from Puerto Rico, all three of which are found only here. Small beetles, the stripes on their elytra curved, collected feeding on the leaves of *Lantana camara* at Río Piedras, are presumed to be this species.

Luperodes antillarum, described by Mrs. Doris Blake as one of her "Ten

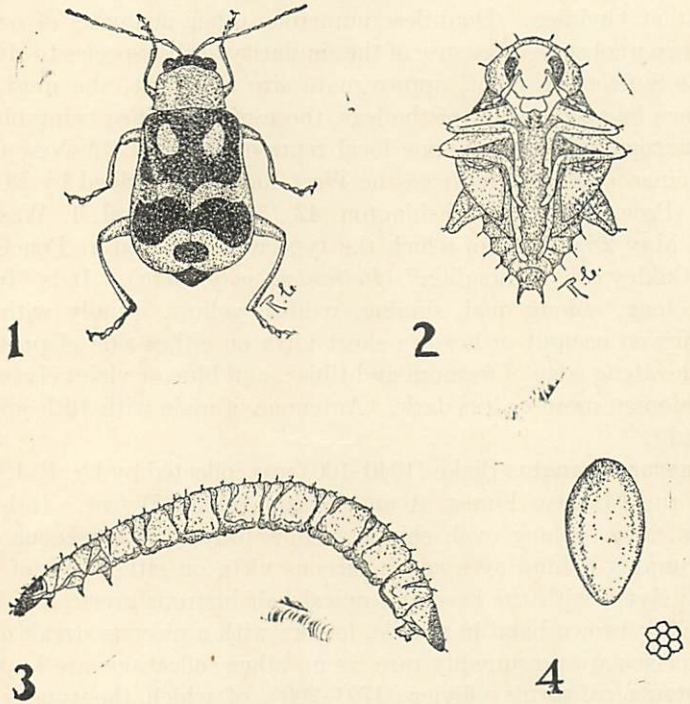
New Species of West Indian Chrysomelidae (Coleoptera)" (Proc. Ent. Soc. Washington, **39** (4): 67–88, pl. 1. Washington, D. C., April 27, 1937), is "elongate oblong, about 4. mm. long, shining dark blue, with deep brown or piceous antennae and yellow legs; thorax sparsely, elytra more coarsely and more densely punctate", of which the type was collected by Dr. Richard T. Cotton at Río Piedras on *Jussiaea suffruticosa*. Additional collections have been made on this host at Loíza, by Dr. Stuart T. Danforth at Yabucoa and on the margin of Cartagena Lagoon, and by Mr. E. G. Smyth at light at Guánica. Doubtless numerous other instances of occurrence have been unobserved because of the similarity of this species to *Altica occidentalis* Suffrian in color, approximate size and host, the most obvious difference being the color of the legs, those of the *Altica* being black.

Ectmesopus vitticollis is one local representative of "A New Genus of Galerucinae (Coleoptera) from the West Indies" described by Mrs. Doris Blake (Proc. Ent. Soc. Washington, **42** (5): 95–104, pl. 1, Washington, D. C., May 28, 1940), of which the type was collected at Ponce by Mr. R. G. Oakley on "hediondilla" (*Peiranisia polyphylla*). It is "from 3 to 4 mm. long, oblong oval, shining, reddish yellow, usually with piceous markings on occiput of head, a short vitta on either side of prothorax, a dark line along edge of fermora and tibiae, and blue or violet elytra, breast and abdomen more or less dark. Antennae of male with 10th joint much enlarged".

Ectmesopus zonatus Blake (1940–100) was collected by Dr. P. J. Darlington in the Maricao Forest at an elevation of 3,000 feet. It is "about 3.5 mm. long, oblong oval, shining yellow brown, with piceous occipital band running behind eyes and a piceous vitta on either side of the prothorax; elytra with the base and apical half lustrous green, and irregular pale yellow brown band in middle, femora with a piceous streak on edge". Both species are presumably rare, as no other collections are known.

Cerotoma ruficornis Olivier (1791–200), of which the type was from the French West Indian island of Guadeloupe, has precedence over the name *Cerotoma denticornis* Fabricius (1792–24), of which the type is from Venezuela. It is under the latter name, however, that Drs. Stahl and Gundlach list this bright red and black pest of beans in Puerto Rico, despite the correct synonymy given by Weise. For the numerous individuals lacking the two irregular black bands across the middle of the elytra, Weise (1885–157) proposed the varietal name **blandula.** At Río Piedras, Mr. E. G. Smyth noted that these "semi-immaculate adults occur 1 to 5 of the normal form". The name *Cerotoma trifurcata* Forster, unfortunately used by Dr. C. W. Hooker (1913–34), refers to this species, and should not be considered a distribution record for the continental species, which does not occur in Puerto Rico. In addition to the early

records on beans, cowpeas and squash, this beetle has been collected on lima beans, and, if not feeding, at least resting on sweet potatoes, cucumber, peppers and sugar-cane. It occurs in abundance in all the coastal regions of Puerto Rico, in all the other Greater Antilles and in most of the Lesser Antilles, as well as in northern South America, Central America and Mexico. In most of these countries it is presumably an introduced species, for it has not been found on Mona, Desecheo, Culebra or Vieques Islands.



The Bean Chrysomelid Beetle, *Cerotoma ruficornis* Olivier: 1, adult, 2, pupa, 3, larva, all about six times natural size; 4, egg, and detail of sculpturing on egg-shell, greatly enlarged. (Drawn by R. T. Cotton.)

Dr. Richard T. Cotton made careful studies on its life-history, publishing (1916–95) illustrations of all stages and recommendations as to methods of control. Since the advent of DDT, the latter are somewhat dated, for 3% DDT dust is very effective in control, entirely avoiding the possibility of injury to host by arsenicals. He found that the female beetles lay their eggs in the soil around the roots of the host plant. "They are a deep yellow in color when first laid, but soon change to a dark reddish-brown. They are eliptical in form, with a surface roughened with small hexagonal pits.

Length 0.6 mm., width 0.3 mm. The eggs hatch at the end of eight days, and the emerging larvae, almost white in color, begin at once to feed on the roots of beans. The larvae feed for a period of from twenty-five to thirty days before pupating. When mature they are white in color, slender, tapering gradually from the head caudad. Head, thoracic and anal plates black, the anal segment with a fleshy proleg. Length 8.0 mm., width 1.0 mm. The pupal stage lasts for a period varying from five to eight days, depending on weather conditions. The pupa is white in color, slender, naked, and furnished with a few scattering hairs. Length 3.5 mm. The beetles may be controlled by collecting them when they first appear and their numbers are few. A small cheese-cloth net may be used for this purpose, and as the beetles are quite sluggish in their movements, they are easily captured and destroyed". Rather surprisingly, Dr. Alex. Wetmore identified none of these beetles in the stomach content of the birds he examined, but Mr. D. W. May noted that they had been eaten by the newly introduced Surinam toad, and they have been found in the stomach of the little grass lizard, *Anolis pulchellus*.

Asbecesta violacea Allard, an Old World species, occurs in Cuba, and in Puerto Rico has been found only at Guánica, collections having been made there by Dr. Stuart T. Danforth, and by Mr. R. G. Oakley on "abeyuelo", *Colubrina ferruginosa*.

Phyllotreta fallaciae Csiki, listed from Puerto Rico by Weise and Dr. Gundlach as *P. fallax* Suffrian, has not since been collected here.

Phyllotreta guatemalensis Jacoby, as determined by Mr. G. E. Bryant and confirmed by Mr. A. J. Mutchler, was found at Mayagüez in enormous numbers on "jazmín de río" *Cleome, gynandra*, and *C. spinosa*, by Rev. R. E. Danforth, the father of Dr. Stuart T. Danforth, in February 1923. They were later noted at Mayagüez in February 1931, and repeatedly since, the only other record being at Coamo in April 1928. Dr. Alex. Wetmore found them eaten by the tody and the cliff swallow. These beetles are about 2.0 mm. long, with dark blue-green head, prothorax and elytra dark blue, evenly and densely punctured, the body black to blue-black in color.

Aphthona auripennis Suffrian, as determined by Mrs. Doris Blake, has been collected by Dr. Stuart T. Danforth at Tortuguero Lagoon, at Manatí on crotalaria, at Juana Díaz and at Mayagüez. Prof. J. A. Ramos (1947–43) found "adults very numerous, feeding on the leaves of *Stigmaphyllon lingulatum*" on Mona Island.

Aphthona compressa Suffrian, which Herr Weise (1885–162) notes "variirt in der Grösse auserordentlich (von 2–4 mm. Länge, und 1.2–2.5 mm. Breite)", also appears to vary considerably in coloring, its prothorax being bright orange to red, and its elytra blue or purple. After

studying all the specimens in the Río Piedras collection, and many others, Mrs. Doris Blake proposes the name *Homoschema*: "A New Genus of Flea-Beetles from the West Indies" (Psyche **57** (1): 10–25, pl. 2. Cambridge, March 1950).

Homoschema latitarsum Blake (1950–16), TYPE from Maricao Forest, others from Indiera and Adjuntas, occurs only in the mountains of Puerto Rico, other collections having been made on coffee at Utuado and Maricao.

The TYPE of the dark-breasted **Homoschema nigriventre** Blake (1950–18) is from Ponce, intercepted by Mr. R. G. Oakley, others from Parguera, San Germán, Manatí, Algarrobo, Sardinera and Río Piedras, also from Mona Island, St. Thomas and St. Croix, U.S.V.I., 2.5 to 3 mm. long, 1.5 mm. wide, with violaceous elytra. **Homoschema fraternum** Blake (1950–19), the TYPE from San Juan, has a narrower aedeagus.

Homoschema obesum Blake (1950–22), the TYPE from El Vigia, Ponce, intercepted by Mr. R. G. Oakley, others from Yauco, Boquerón, Mayagüez, and Algarrobo, 3.2 to 4 mm. long, 2 to 2.8 mm. wide, also with violaceous elytra, is not to be distinguished from the others on the basis of host preference, for all coastal species have been taken on "bejuco de toro", *Stigmaphyllon* (or *Stigmatophyllum*) *tomentosum*, "bejuco de buey", *Banisteria laurifolia*, and other Malpighiaceae.

Aphthona maculipennis Jacoby is a smaller brown beetle with two lighter spots on each elytron. Mr. Thos. H. Jones collected adults feeding on the leaves of *Phyllanthus lathyroides* at Río Piedras, as identified by Dr. E. A. Schwarz. Others collected by Mr. R. G. Oakley on *Myrcia cerifera* at Guánica may be this species.

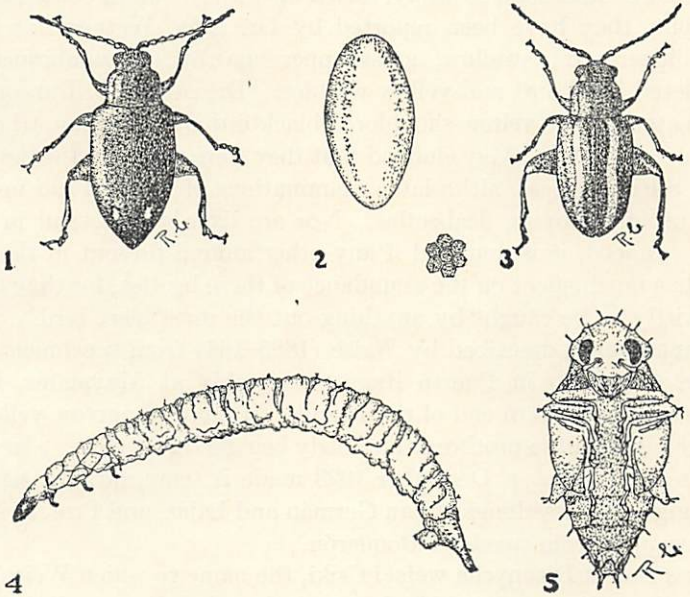
The Cuban *Longitarsus seminulum* Suffrian, as identified by Mr. G. E. Bryant, is a small brown Chrysomelid swept from grass in a salty waste at Salinas.

Longitarsus varicornis Suffrian, a small brown fleabeetle of extended distribution, found in the Gulf Coast States, Mexico and Central and northern South America, as well as in Cuba and Puerto Rico, was noted by Weise (1885–162) and listed by Dr. Gundlach. At times it may occur in enormous abundance, as on *Heliotropium indicum* at Río Piedras and Caguas, on *Psidium guajava* at Coloso, and on tomatoes at Villalba, hosts botanically as widely separated as the localities were geographically where the outbreaks were noted. Specimens from Mona Island, collected by Prof. J. A. Ramos at light, were undetermined as to species by Mr. H. S. Barber.

Dr. Alex. Wetmore reports finding the remains of a fleabeetle identified as a species of *Glyptina* in the stomach contents of a tody, *Todus mexicanus*, but nothing corresponding to this had previously been reported or has since been collected.

Systena basalis Jacquelin-Duval, "La Pulga Americana" of Puerto Rican tobacco growers, is merely listed by Weise, but Dr. Gundlach notes,

"ambos sexos difieren mucho", or, more correctly, the sexes differ considerably from each other. Altho both are generally piceous with greenish luster, the males are smaller and each elytron has a broad median longitudinal golden stripe; the females have faint basal and apical spots on the elytra. Dr. Stahl lists this species as *Haltica basilea* Jacq., and possibly during his lifetime it was not an economic pest of tobacco, for Mr. O. W. Barrett, the first Entomologist at the Mayagüez Station, noted (1904–448) it only on Russian sun-flower. To be sure, it does occur on many other hosts than tobacco, Mr. R. H. Van Zwaluwenburg listing beans, okra and beets, and it is often noted on sugar-cane, but most plants on which it



"La Pulga Americána," *Systena basalis* J. Duval: 1, adult female, 3, adult male, 4, fully-grown larva, 5, pupa; all from eight to ten times natural size, 2, egg, greatly enlarged. (Drawn by R. T. Cotton.)

feeds are solanaceous: eggplant, potato and tomato. Anyone attempting to grow temperate zone garden flowers may find few to many beetles feeding on them; marigold, dahlia, coreopsis, everlasting and others having been noted as attacked.

The list of other observed hosts includes squash, carrots, sweet potato, *Solanum indicum*, *Phaseolus aurens*, *Arracasia xanthorrhiza*, *Portulaca oleracea*, *Valerianodes cayennense*, *Verbesina alata*, *Pluchea odorata*, *Lantana camara*, *Bidens pilosa*, *Synedrella nodiflora*, and *Moluchia tomentosa*, any one of which may be the principal, rather than merely an alternate host plant. The beetle occurs in other of the Greater Antilles, in Cuba

being possibly most abundant during the autumn on the common sunflower, *Helianthus annuus*, feeding on the tender leaves of young plants, but not an economic pest on tobacco or cotton. It was one of the "Common Insect Pest (which) prefer other Host Plants in Haiti" (Jour. Ec. Ent., **20** (2): 429. Geneva, April 1927), cotton being the crop attacked there. Mr. C. C. Gowdey does not even list it in his "Catologus Insectorum Jamaicensis" of 1926, altho it is known to occur there. Dr. Richard T. Cotton made life-history studies, publishing (1916–90 to 93) illustrations of all stages, a list of host plants and recommendations as to methods of control. Possibly because the elytra of these beetles are so characteristic and could be identified so easily, mixed up with the other contents of birds' stomachs, they have been reported by Dr. Alex. Wetmore as eaten by the killdeer, cliff swallow, grasshopper sparrow, mozambique, yellow-shouldered blackbird and yellow warbler. Dr. Stuart T. Danforth found them eaten by the yellow-shouldered blackbird and by the northern water thrush. Mr. D. W. May claimed that they were eaten by the newly introduced Surinam toad, altho later examinations of its food did not include these rapidly moving fleabeetles. Nor are lizards successful in catching them. Indeed, it is doubtful if any other animal present in the environment has much effect on the abundance of these beetles, for they disappear too swiftly to be caught by anything but the most alert bird.

Systena varia, described by Weise (1885–164) from specimens collected by Dr. Gundlach in Puerto Rico, presumably at Mayagüez, is known only from the western end of the Island. It has two narrow yellow bands on each elytron, the prothorax and body being a dull yellow. An outbreak of these fleabeetles in December 1923 made it temporarily a serious pest on young cotton seedlings at San Germán and Lajas, and Prof. J. A. Ramos later swept it from weeds at Boquerón.

Specimens of **Disonycha weisei** Csiki, the name to which Weise's "nigrocoerulea" *pallipes* (1885–159) is now referred, have not been found in Puerto Rico since Dr. Gundlach's original collection.

Disonycha spilotrachela, described by Mrs. Doris Blake (Bull. Brooklyn Ent. Soc. **23** (2): 93–98. Brooklyn, April 1928) with the type from Haiti, others from Tortuguero Lagoon, Puerto Rico, is "brown, pronotum 5–7 spotted, elytra with a common sutural vitta uniting with narrow submarginal one, a discoidal median vitta on either elytron not reaching apex". Besides the type which Dr. Stuart T. Danforth had collected on the shores of Tortuguero, he had others from Aguadilla, and Prof. J. A. Ramos found it at Faro de Cabo Rojo.

Disonycha chlorotica Olivier is listed from Puerto Rico by Weise and Drs. Stahl and Gundlach. Of specimens recently collected at Adjuntas, Mr. H. S. Barber gives the doubtful identification of the Guadeloupe

Oxygona pallens F., noting that "a closely related Cuban specimens has been labeled *Disonycha chlorotica* Oliv., but can hardly be that species". Dr. Stuart T. Danforth had specimens from Maricao and Mayagüez identified as *Oxygona pallens* F., presumably by Mr. A. J. Mutchler. Other specimens to which these names have doubtfully been assigned were collected on sweet potato at Villalba and on *Cacara tuberosa* at Ponce.

The Cuban **Disonycha interstitialis** Suffrian, a yellowish-brown, densely punctured fleabeetle listed by Weise and Dr. Gundlach, has since been found on "roble" (*Tabebuia pallida*) and on *Jasminum sambac* at Bayamón, on *Quercus thompsonii* at Ponce, and, without host records, at Mayagüez, Aguada, Orocovis and Guánica.

To specimens now lost, Dr. Stahl had assigned the name *Disonycha ambulans* Suffrian.

Disonycha eximia Harold, the presently accepted name for what Mr. G. E. Bryant identified as *Disonycha laevigata* Jacoby, occurs in northern South America, Central America and some of the West Indies. It is a bright orange-red fleabeetle; the eyes, antennae except two basal segments, apical half of tibiae and all of tarsi, black and finely pubescent; elytra bright green, shining, impunctate, which when first found in Puerto Rico, occurred in such enormous numbers as to be reported as "An Important New Pest of Beets in Porto Rico" (Jour. Ec. Ent., **16** (5): 459–460. Geneva, June 1924). Concerning it, the Rev. R. E. Danforth made "Notes on the Life-History of *Disonycha laevigata* Jacoby in Porto Rico" (Jour. Ec. Ent., **17** (3): 415–416. Genera, June 1924). The first record in Puerto Rico of this beetle is in August 1921, feeding on the foliage of the weed "bledo" or "blero", species of *Amaranthus*, in great abundance at Yauco and Guánica. At that time, during the cane grinding season, boats came at frequent intervals from La Romana, Dominican Republic, and it is possible that this is an introduced pest from Hispaniola, where it had been known because of its injuries to beets (at Haina, R. D., in 1920). By 1923 it had spread along the west coast to Mayagüez, where Mr. R. E. Danforth had recorded its abundance on "beets, chard, eggplant and many other vegetables", to Hatillo on the north coast, where the "yerba de sal" (*Philoxerus vermicularis*) on the beach was being eaten. Within a few years it was being intercepted on cucumbers at Bayamón, on beans and asparagus at Palo Seco, and on corn, peppers and cucumbers at Loíza, and on the weed "jamón con huevo" (*Achyranthes bettzickiana*). Dr. Stuart T. Danforth had specimens from Utuado, Juncos, Humacao and Ponce, indicating a dispersion to all parts of the Island. He found the remains of this beetle in the stomach contents of an ani at Cartagena Lagoon. It is also recorded as being eaten by the crested lizard, but is possibly too active to be often caught by the introduced toad. The enormous numbers noted resting

on pineapple at Arecibo presumably followed the elimination of "bledo" by weeding, comparable to a similar abundance on beans and sugar-cane at Guánica following weeding, and indeed all records on other than plants of the Chenopodiacea and Amaranthacea may be considered as accidental. Injuries to beets may not come at all, or may not develop until an abundance of foliage has formed, but instances have been noted of attack on the first tender leaves of seedlings just a few inches high. Such young seedlings must be mechanically protected with cold frames or wire screens, if they are to get a start in a region where, or at a time when these beetles are numerous. It is possible that DDT sprayed on the soil surrounding may kill the beetles attacking very small plants, but this has not been tested in the field.

Lactica megaspila was described by Mrs. Doris H. Blake as one of "Seven New Flea Beetles from the West Indies (Coleoptera-Chrysomelidae)" (Psyche, **55** (3): 141–149, pl. 1. Cambridge, September 1948) from collections made by Mr. Carlos M. Matos at Villalba in June 1934. It is 3.1 mm. long, 1.6 mm. wide, "oblong ovate, shining, yellow brown, antennae with the outer joints dark, elytra with four large dark spots having a greenish lustre, two at base and the other two at the apex of the elytra."

Altica jamaicensis F., one of the largest and most abundant of fleabeetles in Puerto Rico, is iridescent dark blue in color, all stages of which, except the pupal, one may expect to see on plants of the various species of *Jussiaea*. Correctly listed by Weise, with *Haltica plebeja* Olivier in synonymy, Dr. Gundlach uses Olivier's name, and notes that the beetles are "común en Cuba". Dr. Richard T. Cotton, in reporting on the "Life-History of *Haltica jamaicensis* Fabr." (Jour. Dept. Agr. P. R., **1** (3): 173–5. San Juan, July 1917), notes that the adults may also survive feeding on the foliage of garden beans; the females lay from 500 to 800 eggs on the leaves of the host plant, pupae are formed in the ground, and the total period from egg to adult is 39 days. The killdeer, tody and cliff swallow were noted by Dr. Alex. Wetmore to have fed on these beetles, and Dr. Stuart T. Danforth found them eaten by the golden warbler and the northern water thrush. They occur on the host plants wherever present, from near the coast to high on El Yunque, those living in the mountains being somewhat larger than those found at sea-level. Exceptionally, these beetles may be found feeding on the leaves of other than the normal host plants: dozens on crape myrtle (*Lagerstroemia indica*) at Río Piedras, several on "mangle" (*Laguncularia racemosa*) near Laguna San José, or resting on seagrape at Guanajibo Dam, on ñame or wild eggplant at Mayagüez.

Altica occidentalis Suffrian feeds on the foliage of all of the various species of *Jussiaea*, and is exactly the same color of iridescent blue as

A. jamaicensis, but is much smaller. From the very similar, yellow-legged *Luperodes antillarum* Blake, which is of the same size, it may be readily distinguished by its black legs. Listed by Weise and Drs. Stahl and Gundlach, it has most recently been attentively observed by Prof. James G. Needham, who, in studying the "Insects from the Seed Pods of the Primrose Willow, *Jussiaea angustifolia*" (Proc. Ent. Soc. Washington, **43** (1): 2–6, fig. 6. Washington, D. C., January 1941), noted that the female "lays her eggs by twos and threes at the end of the pods". Mr. E. G. Smyth found the adults coming to light at Guánica, and they have also been found resting on leaves of sugar-cane there, as well as at Toa Baja and at Bayamón, and on Vieques Island. In September 1935, the tender leaves of a hedge of crape myrtle (*Lagerstroemia indica*) at Río Piedras, were attacked by these beetles, and some of *Luperodes antillarum* Blake, while a month later, when a fresh crop of new leaves was put forth, a few of *Altica jamaicensis* also appeared to share them with the smaller beetles.

Of **Altica rufa** Illiger, listed by Weise and Dr. Gundlach as *Lactica scutellaris* Olivier, Dr. Stuart T. Danforth had specimens, as determined by Mr. A. J. Mutchler, from Adjuntas, Villalba and Mayagüez. The adults are bright red in color, the females laying orange-colored eggs on the leaves of *Trema micrantha* at Indiera, in the mountains north of Yauco. These fleabeetles are not confined to the mountains, however, as individuals have repeatedly been swept from weeds and grass at Río Piedras, and others have been collected on eggplant at Arecibo.

No specimen of the Cuban **Altica gravidula** Suffrian, listed by Weise, has been found in Puerto Rico since the original collection by Dr. Gundlach.

Mr. H. S. Barber has identified some beetles collected on coffee and banana at Ponce, and from the postoffice hedge of "café de la India" (*Chalcas* or *Murraea exotica*) in San Juan as being a species of *Altica* near *pupurascens* Suffrian, and others as **Altica liturata** Olivier. A small elongate blue-black beetle with purplish and greenish reflections, collected on Mona Island by Prof. J. A. Ramos, he considered to belong to a "genus near *Altica*, *Hermaeophaga* or *Syphrea*, probably new".

Dicoelotrachelus violaceus was described by Mrs. Doris Blake from Puerto Rico as one of "Six New Species of West Indian Chrysomelidae" (Proc. Ent. Soc. Washington, **50** (5): 121–7, pl. 1. Washington, D. C., May 1948), the type having been collected at Ponce by Mr. R. G. Oakley. It is "about 3.0 mm. in length, oblong, shining; antennae, head, thorax, scutellum and legs reddish or yellowish brown; elytra violaceous, undersurface brown; thorax with a deep transverse sulcus across the middle."

Glyptobregma cyanellum was described by Mrs. Doris Blake (1948–126) from types collected by Mr. R. G. Oakley on "bejuco de corrales" (*Seriania polyphylla*) in the mountains north of Ponce, and on the leaves of other

plants there and at Adjuntas. It is "from 2 to 3 mm. in length, broadly oblong oval, lustrous blue-violet or sometimes with a blue-green thorax; the antennae, lower part of face, legs and undersurface brownish or yellowish; thorax at the base about the same width as the elytra".

Glyptobregma portoricense, described by Mrs. Doris Blake as belonging to "A New Genus of Flea Beetles from the West Indies" (Jour. Washington Academy of Sciences, **37** (3): 92–95, fig. 5. Washington, D. C., March 15, 1947), is "about 3–4 mm. in length, oblong oval, pale yellow brown, the elytra tending to be a little darker, faintly shining, eyes very large, thorax irregularly and coarsely punctate, elytra semicostate between the partly geminate rows of punctures". Its enormous eyes nearly meet at the vertex. The type was intercepted by Mr. R. G. Oakley at Ponce on *Quercus thompsonii*, others on this host are from Orocovis, and collections have also been made at Bayamón, San Juan and Guánica, on other trees or with the host not recorded.

Pseudoepitrix hoffmani described by Mr. G. E. Bryant (Ann. & Mag. Nat. Hist., **20** (118): 446. London, 1927) for Dr. W. A. Hoffman of the School of Tropical Medicine, who collected the type material, has since been found at Mayagüez, Las Marías and Aguadilla. It is "elongate, light yellow brown, shining, about 2.0 mm. long, with rather prominent eyes", and "the groove behind the tubercles is an inverted V", according to Mrs. Blake (1941–175).

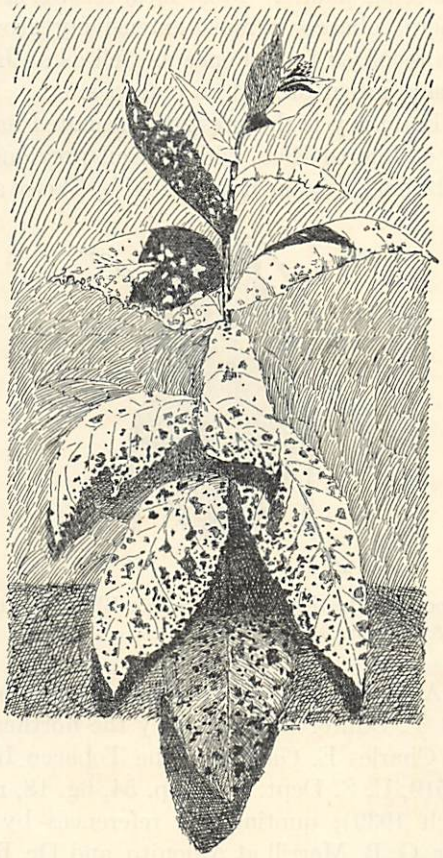
Millions of iridescent blue fleabeetles about 3.0 mm. long, elytra very minutely punctured, were found resting on the leaves of an unidentified tree on a hill northeast of Guayama, January 23, 1922. Described by Mr. G. E. Bryant (Ann. & Mg. Nat. Hist., **13** (9): 302. London, 1924) as a species of *Haltica*, these are now known under the name of **Hermaeophaga cubana** Bryant, altho the type is from Puerto Rico, and, so far as is known, no additional specimen has been collected here or anywhere else.

Hermaeophaga cylindrica, described as a *Haltica* by Weise (1885–160) and thus listed by Dr. Gundlach, is a somewhat more slender, greenish iridescent fleabeetle, repeatedly collected since on "yerba bellaca" (*Croton humilis*) and other wild crotons, often skeletonizing the leaves when they are abundant. It has been noted at Ponce, Yauco, Guánica, Mayagüez and Guajataca, and presumably it is this species which occurs on wild crotons on Mona Island.

Crepidodera asphaltina Suffrian, originally described from Cuba, was collected by Dr. Gundlach in Puerto Rico, and discussed by Weise. It has since been found on squash at Vega Baja, on pepper at Loíza, and Dr. Stuart T. Danforth had specimens from Barranquitas, as determined

by Mrs. Doris Blake. Presumably it was to specimens of this species to which Dr. Stahl applied the name *Crepidodera hirtipennis* Melsheimer.

Epitrix cucumeris Harris, "La Pulga Negra" of Puerto Rican tobacco growers, is the most common and troublesome of the fleabeetles attacking tobacco. It also feeds on other Solanaceous plants, such as potatoes, tomato and eggplant, both cultivated and wild. After Dr. Richard T.

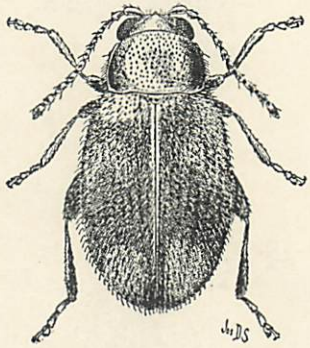


Flea Beetle Injury to Tobacco. (Drawn by Francisco Seín.)

Cotton had worked out its life-history (1916–87), publications by Mr. J. D. More on "Las Pulgas del Tabaco" (Circ. No. 50, Est. Expt. Insular, pp. 8, fig. 3. Río Piedras, October 1921), and by Mr. Luis A. Catoni on the "Plagas de Insectos que atacan la Planta del Tabaco" (Revista Agr. P. R., **7** (5): 45–50. San Juan, 1921) discussed the economic aspects of its presence, and methods of control. Since the advent of DDT as an

insecticide, these have been revised, at least for protecting the younger plants. Indeed, since DDT is less poisonous to human beings than arsenate of lead, its use even on the maturing leaves is to be recommended. Dr. Gundlach and Weise gave only the name *Epitrix fuscata* DuVal for this little black fleabeetle, over which Harris' name has the priority, regardless of its being so inappropriate for a pest which in Puerto Rico attacks only Solanaceous plants. Most local records are from the interior of the Island, where tobacco is most extensively grown, but it occurs everywhere, and is recorded from Ponce as well as at Jájome Alto, where it was almost the only insect present on potatoes.

Epitrix fasciata Blatchley is the presently accepted name for the brown tobacco fleabeetle of Puerto Rico, which in all previous records is called *Epitrix parvula* Fabricius. As such it is listed by Weise and Dr. Gundlach,



The brown Tobacco Flea Beetle, *Epitrix fasciata* Blatchley, twenty times natural size. (After Morgan & Gilmore.)

mentioned by Dr. Alex. Wetmore as having been eaten by the cliff swallow and by Dr. Stuart T. Danforth as eaten by the northern parula warbler, as well as by Dr. Charles E. Gage in "The Tobacco Industry in Puerto Rico" (Circ. No. 519, U. S. Dept. Agr., pp. 54, fig. 18, ref. 11. Washington, D. C., March 1939), quoting the references by Mr. R. H. Van Zwaluwenburg, Mr. G. B. Merrill at Aibonito, and Dr. Richard T. Cotton. It is a somewhat less abundant species than the black tobacco fleabeetle, and is less specialized in its hosts, sometimes being noted in abundance on the leaves of sugar-cane, but not eating them, and Dr. Cotton found it "on *Cleome spinosa*, *Leptilon canadense*, *Lycopersicon esculentum*, *Solanum nigrum*, *Solanum torvum*, tomato and eggplant", and it is recorded from *Physalis angulata* and potato.

Very few Puerto Rican tobacco growers have departed from their accustomed practise of using arsenate of lead or Paris green for the control

of all insects attacking the leaves of tobacco, despite the fact that many new and more desirable insecticides are now available. To date, no experiments have been conducted locally to test even DDT. In consequence, no recommendations can be made as to the effectiveness of this, lindane, the Hyman products and many others, despite the presumption in their favor. The same or similar fleabeetles on potatoes in the States, and the common potato beetles and leafhoppers are ever so much more effectively controlled by DDT and the other new insecticides that average yields have almost doubled. The same effect is hardly to be expected in Puerto Rico on tobacco, but the cost of control might be considerably decreased if more effective insecticides were generally used.

Heikertingerella krugi, which Weise (1885–163) described as a *Homophyla*, is "ovali-hemosphaerica, testacea, nitida, pectore femoribusque posticis brunneis, prothorace elitrisque parce subtilissimeque punctulatis, fere laevibus, long 2. mm.". Dr. Stuart T. Danforth had specimens, as determined by Mrs. Doris Blake, from Matrullas, Villalba and Aibonito, but it is not confined to the mountains, for Prof. J. A. Ramos collected it at Mayagüez and San Germán, as did Mr. R. G. Oakley at Ponce.

Podagrica cyanipennis Weise, as determined by Mr. H. S. Barber, was intercepted on *Volkameria aculeata* at Ponce by Mr. R. G. Oakley. This was described by Weise (1885–165) from the nearby island of St. Thomas as "ovata, convexa, rufa, nitida, antennis infuscatis, elytris laete cyaneis, minus subtiliter punctulatis, ponehumeros transversim impressis, long 4. mm."

Chaetocnema apricaria Suffrian is an exclusively Cuban species, according to Mrs. Doris Blake, who, in describing "New Species of *Chaetocnema* and other Chrysomelids (Coleoptera) from the West Indies" (Proc. Ent. Soc. Washington, **43** (8): 171–180, pl. 1. Washington, D. C., November 29, 1941), attempts to "straighten out the identity of the species of the *Chaetocnema* in the West Indies that in the past have been labeled indiscriminately as *C. apricaria* (Suffrian)". Listed as a *Plectroscelis* by Weise, and by Drs. Gundlach and Stahl, the Puerto Rican material is divided by her among four distinct species.

Chaetocnema brunnescens Horn, collected originally at Key West, Florida, by Dr. E. A. Schwarz, presumably on mangrove, is primarily a West Indian species, found in the Bahamas, and along the coast of Hispaniola, Puerto Rico and St. Thomas. The brownish curved slits so often noted on the underside of the leaves of mangrove (*Rhizophora mangle*) are due to the activities of this species, definitely recorded from Laguna San José, Martín Peña, Dorado and Mayagüez, and by Dr. W. A. Hoffman on Santiago Island at Humacao Playa. Similar injury to "rosa de ciénaga"

(*Ginoria rohrii*) was observed at Boquerón in May 1923, when the adults were present in great abundance, and noticeably not very active in jumping away when disturbed. At the time, Dr. E. A. Schwarz was of the opinion that this beetle was not responsible for the injury, and that it did not feed on the plants on which it was found. Mrs. Blake definitely identifies it as the same species which he collected at Key West: "paler brown; a greenish metallic lustre and a conspicuously punctate head, larger and more elongate than the other West Indian species".

Chaetocnema elachia, "a much smaller species, very tiny, with a very much more finely punctate thorax", is described by Mrs. Blake as "oblong oval, about 1.5 mm. long, shining deep brownish black, with legs (except the dark hind femora) and antenna paler, elytra not depressed" from material collected by Mr. August Busck on Vieques Island in February 1899. It is also recorded from Río Piedras, collected by Mr. Thos. H. Jones on wild morning glory, and to this species may possibly be referred those fleabeetles sometimes found in almost destructive abundance on the leaves of sweet potato.

Chaetocnema perplexa Blake, is also often taken on *Convolvulus* elsewhere than in Puerto Rico, and occurs in Bermuda, Cuba and Hispaniola, the only specimen of this *confinis* group, as identified by her, from Puerto Rico being one intercepted by Mr. R. G. Oakley at Ponce on tomato leaf.

Chaetocnema laticeps Blake, of which the type is from Trou Caiman, Haiti, has been collected at Guánica Lagoon. It has an "unusually broad head and wide interocular spaces, as well as punctate upper and lower surface," according to Mrs. Blake.

Chaetocnema nana Jacoby, as determined by Mr. G. E. Bryant, was found in great abundance on grass growing in salty land near Salinas in August 1921.

As to all the other records from Puerto Rico: on squash at Guaynabo, on cassava at Loíza, on tomato at Jayuya, on *Guilandina crista* and *Scirpus validus* at Ponce, on *Volkameria aculeata* at Boquerón, of being eaten by the lizard, *Anolis krugii*, and Dr. Wetmore's records of being eaten by the ani, the yellow and parula warblers, only re-examination of material will indicate to which species of *Chaetocnema* each should be assigned.

Blepharida irrorata Chevrolat, listed by Weise and Dr. Gundlach, has since been collected on *Matayba* at Ponce by Mr. R. G. Oakley.

Omophoita albicollis Fabricius, a very active brown fleabeetle, with bright yellow pronotum and five yellow spots on each shining brown elytron, is probably what Weise and Dr. Gundlach list as *Oedionychis 10-guttata* Fabricius. Dr. Stahl gives the name *Oedionychis aequinoctialis* F., Dr. E. A. Schwarz identified specimens as *Homophoeta aequinoctialis* Fbr., and Mr. C. A. Frost as *H. equinoctialis* L. The specimens from

Belém do Pará, Brasil, identified by Mr. G. E. Bryant as *Homophoeta aequinoctialis* L., and those from British Guiana have the central yellow spot on the elytra oval; on all those from Vieques Island and Puerto Rico it is a narrow transverse band: an obvious difference between two similar species with similar continental distribution, of which *albicollis* only occurs in the West Indies. Wild heliotrope (*Heliotropium* or *Tiaridium indicum*) was found heavily infested by these beetles at Caguas by Dr. Richard T. Cotton, and Mr. F. Seín noted the same host being eaten at Boquerón. As this is a common weed in cultivated land, records of the beetles resting on sugar-cane and other plants at many localities in various parts of the Island are to be expected.

Omophoita cyanipennis Fabricius is very striking in appearance because of its dark iridescent blue elytra, most of the rest of the beetle, including its greatly enlarged hind femora being yellow in color. It occurs in all the Greater Antilles, and in St. Thomas and St. Croix, but has not been found on Vieques, Culebra or Mona. Listed as an *Oedionychis* by Weise and Dr. Gundlach and Dr. Stahl, the habits of the female have recently been noted by Prof. James G. Needham (1941–5) as she "lays her eggs in clusters of a dozen or more on the underside of the leaves" of the primrose willow, *Jussiaea angustifolia*. Adults have also been found on other species of *Jussiaea*, but Mr. E. G. Smyth considered them "general feeders, on *Verbesina*, *Valerianodes*, *Pluchea*, *Physalis* and other plants". Repeatedly noted resting on leaves of sugar-cane, they were in such abundance on the leaves of mangrove at Laguna San José near Río Piedras, and on *Volkameria aculeata* at Boquerón as possibly to indicate these latter as true host plants.

Oedionychus bicolor Linnaeus, superficially similar in general appearance to *Omophoita cyanipennis*, is somewhat shorter, its elytra are a lighter and somewhat greenish blue, as are also its distended hind femora. According to Mrs. Blake (1940–173), "it occurs in Puerto Rico, and the Virgin Islands (St. John, St. Thomas, St. Croix, Virgin Gorda)", the records from Cuba and Hispaniola referring to other species. The French Botanist Ledru (1780) refers to this beetle in Puerto Rico under the generic name of *Altica*, and Weise and Dr. Gundlach as an *Oedionychis*. In March 1923, it was found in great abundance at Pt. Salinas (between Palo Seco and Toa Baja) on *Volkameria aculeata*, the other records being on unidentified hosts at Laguna San José and at Dorado. Its very limited distribution in Puerto Rico, practically confined to the San Juan area, has been modified by a single record at Ponce by R. G. Oakley, and others at Guánica by Prof. J. A. Ramos.

Oedionychis decemguttata Fabricius, listed by Weise and Dr. Gundlach,

has not since been found in Puerto Rico, and it may be presumed that their record refers to *Omophoita albicollis* Fabricius.

Hadropoda morrisoni, the most abundant of the seven "New Species of *Hadropoda* Suffrian from the West Indies" (Bull. Mas. Comp. Zoölogy, **92** (8): 413–41, pl. 4. Cambridge, August 1943) described by Mrs. Doris Blake from Puerto Rico, is presumably what Dr. Gundlach listed under the name *Hadropoda ferruginea* Suffrian. The type is from Maricao, and altho most collections have been made in the mountains, at Adjuntas, Corozal, Cidra, and at Indiera in the mountains above Yauco, Mr. A. S. Mills found individuals on the coast at Loíza Aldea. These beetles were so abundant in the summer of 1941 at Aguas Buenas as to completely destroy rose bushes, but this is the only host record. They are "about 2 mm. in length, oblong oval, faintly shining under the fine, closely appressed, pale pubescence, pale yellow brown with two apical joints of the antennae and a median elytral spot, dark brown".

Hadropoda barberi Blake (1943–440) is a short, plump species, 2 mm. long, with oval elytra, wingless, the type from Villalba and others from Adjuntas on areca "palm" (*Areca catechu*), collected by Mr. R. G. Oakley.

Hadropoda eugeniae Blake (1943–422) is exceptionally large, 4.5 mm. long, with raised spots on the elytra like warts, and a "dense curling pubescence", the type collected by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*) at Indiera in the mountains above Yauco.

Hadropoda rugosa Blake (1943–427), the type from El Yunque, collected by Dr. P. J. Darlington, is 3.5 mm. long and has fewer pronounced warts.

Hadropoda oakleyi Blake (1943–422) is named for the "interceptor" of the type. It is "between 2 and 3 mm. in length, finely pubescent, pale yellow brown, with numerous dark elytral spots". It was collected on "pomarrosa" (*Eugenia jambos*) at the Natale finca in the mountains above Yauco.

Hadropoda tabebuiae Blake (1943–437), 3 to 4 mm. long, of which most specimens were from coffee groves near Adjuntas or on "roble" (*Tabebuia pallida*) in the mountains above Ponce, is of very variable depth of coloration, "some being nearly piceous, while others are pale, some have a dark thorax and pale elytra, while others have a pale thorax and dark elytra. The dense golden pubescence is particularly noticeable in dark specimens".

Hadropoda varicornis Blake (1943–423), 2.7 mm. long, has "spotted elytra combined with varicolored antennae". The type was collected by Mr. R. G. Oakley on *Ocotea* at the Torres finca, in the mountains above Ponce.

Ochthispa loricata, described by Weise (1885–166) from specimens collected by Dr. Gundlach, presumably at Mayagüez, is an elongate, reddish-brown Chrysomelid with the outer humeral and apical angles of its quad-

rangular elytra expanded into prominent horns. Adults "were very common near Macuto, Venezuela, feeding on sea-grape leaves", as reported in "Notes on the Insects of the Sea-Grape, *Coccoloba uvifera* (L.) Jacq., in Porto Rico" (Jour. Ent. Research, **17** (1): 49–52, ref. 6. London, July 1926), but only recently have they again been found in Puerto Rico: at Mayagüez by Dr. H. L. Dozier, and by Mr. L. Courtney Fife, in 1935.

The specific name of **Hilarocassis exclamationis** Linnaeus is suggested by the narrow, interrupted black band on the disc of each elytron of this large, straw-colored tortoise beetle: the largest occurring in Puerto Rico. As a *Mesomphalia* it is listed by Weise and Dr. Gundlach, but in recent years it has been excessively rare. Dr. Alex. Wetmore found it in the stomach contents of a cuckoo, but it is not again recorded until an outbreak occurred in the summer of 1936 at Ponce, which was so noticeable that photographs of the insect were reproduced in "El Imparcial". Most of the adults collected at this time were resting on "higuereta" (*Ricinus communis*) and presumably this is the host, but no larvae were seen. For over a year thereafter, scattered adults were to be found in cane fields: at Guánica, Aguadilla and Manatí.

The type of **Aedmon sericellum,** described by Mr. Hamlet Clark in his "Catalogue of the Halticidae in the Collection of the British Museum" (p. 131. London, 1860), is from Puerto Rico. No specimen to which this name might be assigned has since been collected.

A single specimen of a small brown Chrysomelid found on swamp vegetation at Boquerón in May 1923 was determined by Mr. G. E. Bryant as **Hypolampsis inornata** Jacoby, a Mexican species not elsewhere known. Additional specimens of this genus, identified by Mr. H. S. Barber, as "near" this species, have subsequently been found by Mr. R. G. Oakley on a variety of hosts in southwestern Puerto Rico, and by Prof. J. A. Ramos at Adjuntas and Maricao.

Megistops fictor, described by Weise (1885–162) from specimens collected by Dr. Gundlach in Puerto Rico, is another small brown beetle, "long 3 mm., brunneus, elytris subtilissime granulato-punctatis, macula basali lineolisque 3 ante apice dilute luridis". Mr. R. G. Oakley has since found this beetle on "roble" (*Tabebuia pallida*) at Guánica.

Megistops liturata Olivier, as determined by Mr. H. S. Barber, was collected by Mr. R. G. Oakley on *Scirpus validus* and *Tabebuia pallida* at Ponce. It is probably this Hispaniolan species which Dr. Luis F. Martorell found on "cupey" (*Clusia rosea*) on Mona Island.

From *Mayepea domingensis* at Guánica, Mr. R. G. Oakley intercepted beetles identified by Mr. H. S. Barber as a species of **Argopistes.**

Chalepus sanguinicollis Linnaeus is a slender, elongate, blue-black beetle, 7–8 mm. long, with the base of elytra and pronotum red, found in Argentina

and Brasil, as well as in Cuba, Hispaniola, Puerto Rico, Vieques, St. Thomas, St. Croix and Grenada. It is listed by Weise and by Drs. Stahl and Gundlach as *Odontota axillaris* Duv., and numerous individuals have since been collected resting on a wide variety of plants in all the more humid parts of the Island. Prof. J. A. Ramos has most recently found it on Mona Island.

Chelymorpha multipunctata Olivier, listed by Weise and Dr. Gundlach and identified by Dr. E. A. Schwarz as *Chelymorpha polysticha* Boheman, is the more common of the oblong-oval, convex, brick red tortoise beetles of this genus which occurs in Puerto Rico. It has an abundance of black spots on the elytra, arranged quite regularly in rows on the disc, but tending to break up into groups of black punctures along the lateral margins. It is apparently not so common as formerly, for Mr. August Busck collected numerous specimens at Fajardo in February 1899. Two specimens were recently noted resting on sugar-cane: at Juncos and at Loíza; Dr. Richard T. Cotton found it on egg-plant at Juncos; Mr. Thos. H. Jones one on wild morning glory at Río Piedras; Prof. J. A. Ramos one at Mayagüez; and Dr. Stuart T. Danforth had one from Barros and found another eaten by the oriole at Cartagena Lagoon.

What is now listed as subspecies **geniculata** Boheman of **Chelymorpha cassidea** Fabricius was considered a valid species by Weise. Listed by Dr. Gundlach, it is not at all common, altho Dr. Richard T. Cotton (1918–308) mentioned it as a pest of sweet potatoes. It has fewer spots on the elytra and more on the pronotum.

Deloyala guttata Olivier, listed by Weise and Drs. Stahl and Gundlach as a *Coptocycla*, is a tortoise beetle which when alive is bright golden in color, broadly oval, subdepressed, with the margins of its thorax and elytra broadly expanded, very thin and transparent, the humeral angles black. It is often found on wild morning glory, and more rarely on sweet potato vines. Dr. Alex. Wetmore noted it as eaten by the ani, kingbird, cliff swallow, mockingbird, yellow-shouldered blackbird, oriole and grasshopper sparrow, and Dr. Stuart T. Danforth found it eaten by the semipalmated sandpiper at Cartagena Lagoon. As *Coptocycla signifera* Herbst it was listed by Mr. Thos. H. Jones (1916–6) as a pest of sweet potato, and by Dr. R. T. Cotton (1918–307), the latter noting that "the peculiar-shaped, yellowish larvae also feed on the leaves, but do not cause nearly as much damage as do the adults". This tortoise beetle occurs in all the Greater Antilles, the United States, Central America and Brasil, and in Puerto Rico has been collected at Ponce, Yauco and Boquerón, as well as in the more humid regions of both coast and mountains. In October and November of 1939, these beetles were noted in great abundance on sugar-cane at Guánica, the adults having been forced to migrate from small vines of

morning glory when these were weeded from the cane fields and their margins.

Four species of **Metriona** are listed from Puerto Rico, the type of that which C. H. Boheman in his "Monographia Cassididarum" (**3:** 333. 1865) describes as *Coptocycla* **glaucina** being from the Island, altho this is not listed by Weise, who gives only *Coptocycla* **bisbinotata** Boheman.

Metriona quadrisignata Boheman, as identified by Mr. H. S. Barber, of specimens collected at Ponce, is also represented in the Stuart T. Danforth collection by specimens from Aibonito. Prof. A. J. Ramos made collections in the Maricao and Guánica Forests; those from the mountains, when alive, being singularly beautiful, looking like pieces of gold against the dark green vegetation.

The Cuban and Hispaniolan species **Metriona subsignata** Boheman is listed from Puerto Rico, but is represented by no recent collection. Indeed, the only tortoise beetles recently noted to which this name may refer were found in great abundance on wild morning glory and on sweet potato foliage by Prof. J. A. Ramos at Mayagüez in July 1943. They had two golden stripes on the black background of each elytron, and seem identical with others from Haina, Dominican Republic, which Dr. E. A. Schwarz had identified as *Metriona propinqua* Boheman.

Bruchidae (Mylabridae): Bean and Pea Weevils

The bean and pea weevils do not have the pronounced beak of the true weevils, but are short little thick-bodied beetles with the tip of the abdomen not covered by their short elytra. The females of many species lay individual eggs in the immature bean or pea, the larva develops inside, often emerging as an adult in a country far distant from that in which it originated. Others are able to oviposit in dried legumes in storage, and several generations may develop before the infested beans are discarded as valueless for human consumption. Thus the records of occurrence of several of the economic species in Puerto Rico may refer to finding them in dried beans or peas actually present in Puerto Rico at the time of the collection of the specimens, but which had been grown and become infested in the United States, Spain or Venezuela. After the infestation of the dried legumes becomes apparent in Puerto Rico is too late to prevent or avoid injury.

Bruchus pisorum Linnaeus, the cosmopolitan pea weevil, may, or may not attack peas here, but adults have been repeatedly been collected here, their host being dried peas from other countries. Usually but a single grub develops in one pea, and the species can not reproduce in dry peas.

The single record of the broad bean weevil, **Bruchus rufinanus** Boheman,

as determined Mr. E. G. Smyth, is of being reared in Puerto Rico from broad beans from Spain.

Acanthoscelides amicus Horn, found in Texas, Arizona and lower California infesting the seeds of the screw bean or tornillo, is reported from Puerto Rico.

Acanthoscelides centrimaculatus Allard, is recorded by Dr. Gundlach from Puerto Rico under the name *Bruchus cinerifer* Chevrolat, with the note: "Tambien se encuentra en la flor del Júcaro (*Terminalia*) en la Cienaga de Zapata en Cuba". No specimen has since been collected here which can be referred to this, the only Bruchid mentioned by Dr. Gundlach.

The record of **Acanthoscelides livens** Suffrian is based on a doubtful determination by Dr. E. A. Schwarz of a single reddish-brown Bruchid collected from the arrows of sugar-cane at Río Piedras.

Acanthoscelides dominicanus Jekel, originally determined as a *Bruchus* by Mr. G. E. Bryant, and subsequently re-determined by Messrs. H. S. Barber and A. J. Mutchler, has repeatedly been reared from the pods of "aroma" (*Acacia* or *Vachellia farnesiana*) and of mesquite or "bayahonda" (*Prosopis* or *Neltuma juliflora*), at Guánica and Boquerón, in the southwestern corner of the Island. From "yerba de San Martín" (*Sauvagesia erecta*) growing in the Guánica Forest, Prof. J. A. Ramos has reared these weevils. The adult is an elongate, light brown beetle, with a group of irregular darker spots on the disc of the elytra so short as to leave exposed almost a third of the abdomen.

Acanthoscelides obtectus Say, the cosmopolitan bean weevil, has been repeatedly reared from dry beans imported from the United States and from Venezuela. Possibly it is a permanent resident, for we have one record of its occurrence in white beans grown locally, but none in red beans. After the primary infestation in the field, succeeding generations of females are able to oviposit in dry beans held in storage, so that eventually all beans are completely destroyed.

Acanthoscelides ochraceicolor Pic, as determined by Mr. H. S. Barber, was found by Mr. R. G. Oakley in the flowers of "guácima" (*Guazuma ulmifolia*) at Ponce.

Mr. J. C. Bridwell identified as "close to *prosopis* LeConte" the *Acanthoscelides* weevils which Mr. D. L. Van Dine reared from pods of "algarrobo" (*Hymenaea courbaril*) at Río Piedras in April 1911. Similarly somewhat doubtful is the identification by Mr. H. S. Barber of *Acanthoscelides podagricus* F. for the weevils which Prof. A. J. Ramos reared from pods of *Ichthyomethia piscipula* at Faro de Cabo Rojo.

Acanthoscelides *SALLAEI* Sharp was identified by Mr. H. S. Barber for weevils collected by Mr. R. G. Oakley at Ponce, but others from southwestern Puerto Rico he thought to be only "near" this species.

Acanthoscelides xanthopus Suffrian, a Cuban Bruchid, was identified by Mr. H. S. Barber from Puerto Rican material: collections at Mayagüez by Prof. J. A. Ramos and at Guánica by Mr. R. G. Oakley. Other Bruchids collected at Ponce on flowers of *Randia mitis*, and of *Peiranisia polyphylla*, are "near" this species.

Callosobruchus chinensis Linnaeus, a cosmopolitan cowpea weevil, has often been reared in Puerto Rico from cowpeas originating elsewhere, but it may indeed be established here, as it has once been reared from dry pigeon peas at Río Piedras by Mr. A. S. Mills.

The southern cowpea weevil, **Callosobruchus maculatus** Fabricius, as determined by Mr. H. S. Barber, has been collected on moca at Ponce, on avocado at Utuado and at San Juan. The variety **barbicornis** Fabricius is listed by Leng & Mutchler. This cosmopolitan species, commonly referred to under the synonym of *Mylabris quadrimaculatus* Fabricius, the four-spotted bean weevil, has several times been found destroying cowpeas imported from the States, and once has been collected from infested dry peas from Georgia.

Mr. J. C. Bridwell names "A New **Amblycerus** affecting Seeds of *Prosopis chilensis* in Puerto Rico and Hispaniola" (Jour. Agr. Univ. P. R., **27** (3): 133–5. Río Piedras, September 11, 1944) **martorelli,** after Dr. Luis F. Martorell, who reared the type material from seed-pods of *Neltuma juliflora* at Guánica. This is a reddish-brown beetle, from 5 to 6.5 mm. long, "uniformly yellowish cinereous above and pale beneath", which is also found in Hispaniola, where it was reared from the same host, mesquite or "bayahonda".

Zabrotes subfasciatus Boheman (=*Spermophagus pectoralis* Sharp), the Mexican bean weevil, another cosmopolitan Bruchid, has been reared from beans and peas from the States and from Venezuela. Because of its temporary abundance from outside sources, it may come to light in large numbers, or be found in the stomachs of birds, as it is reported by Dr. Alex. Wetmore as eaten by the flycatcher, wood pewee and parula warbler.

Caryobruchus giganteus Chevrolat, as a *Pachymerus*, is listed from Puerto Rico by Leng & Mutchler.

Anthribidae: Fungus Weevils

Homocloeus conspersus, described by Herr P. Wolfrum in his short paper "Ueber Anthribiden von Cuba" (D. E. Z., 1930, pp. 25–32) from Puerto Rican material, is presumably the same species as that repeatedly intercepted by Mr. R. G. Oakley: on moca at Ponce, on coffee at Adjuntas and on guava at Aibonito. Unfortunately, none of the specimens in this family collected by Mr. Oakley in Puerto Rico, and identified only to genus by Mr. L. L. Buchanan, was available to Herr Wolfrum for description.

On dead wood at Indiera, in the mountains north of Yauco, Mr. Oakley found a new species of **Gymnognathus,** and a new species of **Neanthribus** on pomarrosa in the mountains north of Ponce.

Ormiscus micula Jordan, described from Grenada, and present also in St. Vincent, is the only named species of this genus present in the West Indies. Numerous specimens of **Ormiscus** have been collected in Puerto Rico, however, Dr. Stuart T. Danforth having them from Tortuguero Lagoon and from Coamo. At least two distinct species were intercepted by Mr. Oakley in the Ponce region: found resting on trees or rotten wood, or on the flowers of *Inga laurina* in the mountains above Yauco.

Brachytarsus sp. was the determination given by Dr. E. A. Schwarz to some small spotted Anthribid beetles found at Boquerón in 1923 in pods of "aroma" (*Acacia farnesiana*), but not since noted.

Euxenus anthoceroides Wolfrum (1930–31) is known only from the type from Puerto Rico.

Brentidae: Primitive Weevils

Paratrachelizus linearis Suffrian, described originally from Cuba, was found both there and in Puerto Rico by Dr. Gundlach "debajo cortezas". It is typical in appearance of these extremely elongate Brentid or Brenthid weevils, but has a short head behind the eyes, and an entirely smooth but dull, dark reddish-brown body, without markings.

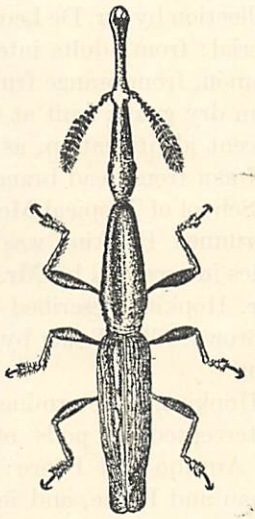
Stereodermus exilis Suffrian, described originally from Cuba, is the only species of this genus recorded from any of the West Indies. **Stereodermus** species is the determination by Mr. L. L. Buchanan of the specimen intercepted by Mr. Stuart D. Whitlock at Mayagüez on decaying wood.

Belopherus maculatus Olivier is found in the larger of the Greater Antilles, being listed by Dr. Gundlach from Puerto Rico as *Belophorus militaris* Olivier "debajo de la corteza muerta". It is usually not more than an inch long, mostly shining dark brown in color, with lighter yellowish eyes and elongate spots on its deeply striate elytra, the outer posterior angles of which are produced in sharply pointed horns. All records are of occurrence in the mountains, under the dead bark of trees, or resting on the trunks of trees or mountain palms.

Brentus volvulus Fabricius varies greatly in size, some individuals being scarcely an inch long, while others are twice as long. Its deeply striate elytra are marked with four elongate yellowish spots, often tending to become confluent, but normally sharply separated. It occurs along the coast of Puerto Rico, as well as in the lower mountains, not only under dead bark of trees and on their trunks, but also on corn and cotton, a pair having been found on grapefruit blossoms at Mayagüez. At the highest

elevations, these elongate beetles have been found on coffee leaves and in virgin forest.

Brentus vulneratus Gyllenhal, listed in 1780 by the Botanist Ledru from Puerto Rico as *Brentus nasutus* F., and subsequently by Drs. Stahl and Gundlach as *Brentus turbatus* Boheman, occurs also in Mexico and Central America, as well as in others of the Greater Antilles. No recent collection from Puerto Rico is recorded, but possibly those individuals with concavely outwardly distended posterior margins of the elytra may be assigned to this species, those with normally curved and neatly tucked-in elytra being *Brentus volvulus*. Most of these large beetles are heavily



Brentus volvulus F., twice natural size. (Drawn by F. Maximilien.)

infested with the nymphs of Uropodid mites: a strange choice it would seem, if the mites are expecting rapid transportation, for their hosts are decidedly slow-moving, at least in the daytime. Nothing is known of the immature stages of these beetles, and we can merely presume that the larvae are borers in rotten wood.

Scolytidae: Bark & Timber Beetles

Hypothenemus eruditis Westwood, as identified by Dr. M. W. Blackman, was collected by Dr. Donald De Leon at Camp Doña Juana, Villalba, in a small dead pole of "maricao" (*Byrsonima spicata*), and in dead twigs of "masa" (*Tetragastris balsamifera*) at Ciales.

Hypothenemus of a species near **parvus** Hopkins, as determined by Dr.

M. W. Blackman, has entirely different habits, adults having been intercepted in orange fruits at Ponce and Mayagüez, in fruit of "maga" (*Montezuma speciosissima*) at Vega Alta, in dry tobacco at Loíza and in dry pigeon peas at San Juan. Dr. Hopkins described *parvus* from females 1.0 mm. in length collected by Dr. E. A. Schwarz at Cayamas, Cuba "from old cotton bolls."

Stephanoderes brasiliensis Hopkins, as determined by Dr. M. W. Blackman, was reared by Dr. Donald De Leon from larvae in the stems of *Derris eliptica* being grown at Río Piedras: a possible clue as to how an insect described from Pernambuco, Brazil should be found in Puerto Rico. In fact, however, this species had been definitely identified by Dr. Blackman several years before its collection by Dr. De Leon, but after the introduction in 1930 of the host material: from adults intercepted in decayed flowerstalks of banana at Bayamón, from orange fruit at Ponce, from almendra fruit at San Germán, from dry guava fruit at Corozal, from grapefruit at Bayamón. The most recent identification, as "near," is of material collected by Dr. W. A. Hoffman from dead branches of flamboyán (*Delonix regia*) in the patio of the School of Tropical Medicine.

Stephanoderes near **brunnea** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted by Mr. R. G. Oakley in mangrove seed balls at Ponce. Dr. Hopkins described *brunnea* from females 1.35 mm. long, collected at Brownsville, Texas by Mr. H. S. Barber, "body stout, dark brown, shining."

Stephanoderes buscki Hopkins, as determined by Dr. M. W. Blackman, has been repeatedly intercepted in pods of "algarrobo" (*Hymenaea courbaril*), at San Juan, Arecibo and Ponce; in tamarind (*Tamarindus indica*) pods from San Juan and Ponce, and in mummied guava fruit at Peñuelas. The type of *buscki* was collected by Mr. August Busck in Trinidad, B. W. I.

Stephanoderes georgiae Hopkins was found in the same mummied guava fruit from Peñuelas, associated with *S. buscki*. The type of *georgiae* is from the State of Georgia, U. S. A.

Stephanoderes near **ferruginea** Hopkins was the determination by Dr. M. W. Blackman of beetles found by Dr. Luis F. Martorell infesting the dried seed pods of "emajaguilla" (*Thespesia populnea*) along the road from Guayanilla to Ponce.

Stephanoderes "near, but not *hampei* Ferrari" was the determination by Dr. M. W. Blackman of beetles reared from mummied or cull *excelsa* coffee berries from Lares in 1941. Mr. Francisco Seín found no larvae in green berries of *excelsa*, or in those of which pulp surrounded the beans, but only in the mummied fruit, and none in any kind of berries of *arabica* coffee, even those which were mummied on trees in the same grove as the *excelsa*

trees. Search for other *excelsa* trees in Puerto Rico indicated that the mummied fruits from these scattered trees were also infested, and that the beetle had not previously been noted because the few trees at Lares were the first to yield enough berries to be commercially processed.

Stephanoderes near **guatemalensis** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted at Arecibo in decaying papaya fruit. The type of *guatemalensis* was from cacao fruit.

Stephanoderes opacifrons was described by Dr. A. D. Hopkins in his "Classification of the Cryphalinae, with Descriptions of new Genera and Species" (Report No. 99, Office of the Secretary, U.S.D.A., pp. 1–75, pl. 4. Washington, D. C., 1915) from females 1.1 mm. long, dark brown, opaque, collected by Mr. August Busck in January 1899 at Aguadilla, Puerto Rico. No specimen identified as this species has since been found in Puerto Rico.

Stephanoderes near **texanus** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted on citron at Palo Seco.

Stephanoderes trinitatis Hopkins, as identified by Dr. M. W. Blackman, was collected by Dr. Donald De Leon from a dead twig of "guaraguao" (*Guarea trichilioides*) at Patillas, associated with another species of *Stephanoderes* which could not be identified. The type of *trinitatis* was collected by Mr. August Busck at Monteserrat, Trinidad, B. W. I., with no host indicated.

Additional species of **Stephanoderes** doubtless occur in Puerto Rico, for Dr. Hopkins did not assign a name to those collected from dying twigs of Australian silver oak (*Grevillea robusta*), nor have many intercepted since been identified. The lizards *Anolis pulchellus*, *Anolis stratulus* and *Anolis cristatellus* eat these beetles in considerable numbers, but seldom many at any one time. They also eat considerable numbers of similar small beetles of the genus *Xyleborus*, which are often twice as large or larger than *Stephanoderes*. The *Xyleborus* beetles are a considerable item in the food of the cliff swallow, as noted by both Dr. Alex. Wetmore and by Dr. Stuart T. Danforth. The barn swallow and the spotted sandpiper were found by Dr. Danforth to eat *Xyleborus* beetles, and Dr. Wetmore found them in the stomach contents of the parula and yellow warblers, and of the honey creeper.

Xyleborus affinis Eichoff is possibly the most abundant species of the shot-hole borer beetles, and has an extremely wide distribution, being found from as far north as New Jersey in the United States "in oak stumps," in most of the countries of Central America, in many of the West Indies and especially in all of the Lesser Antilles where sugarcane is grown, to tropical South America, including Argentina. Dr. Hopkins notes in his description (1915–64) of *Xyleborus sacchari* from St. Vincent that "this is at once distinguished from specimens identified by Eichloff as *X. affinis*,

and received from his type series, in the smaller size and more shining front and also in the distribution," but Dr. M. W. Blackman in April 1935 wrote: "I regard *Xyleborus sacchari* Hopkins as no more than a variety of *X. affinis* at best, and in a long series of so-called *sacchari*, typical *affinis* appear usually to be present." Formerly it was of very considerable economic importance because of heavy infestations of sugar-cane, more especially of the old Otaheite or white cane, which was one of the original varieties on which the industry was based. Otaheite cane grows well on virgin soil, but is poorly adapted to old, worn-out soils, and was entirely displaced where more vigorous varieties were developed. At the present time it is doubtful is any of this variety can be found anywhere in the world. The newer varieties of sugar-cane are practically or entirely immune to attack by these shot-hole borer beetles, which in recent years have not been noted on sugar-cane anywhere in Puerto Rico. Nevertheless, *Xyleborus affinis* is still a serious pest, attacking coconut palm tree trunks, and what appear to be perfectly healthy trees of *Albizia lebbeck*, sometimes perfectly healthy trees of *Inga vera* and *Inga laurina*, and is almost invariably present in the trunks of these coffee shade trees which show any indication of disease or injury from some other cause. It is very difficult to prove that in every case of infestation the tree was previously injured or diseased, but it is quite possible that these beetles may attack those which were perfectly sound, as were the stalks of Otaheite cane when they were attacked. Fortunately, most coconut palms and most coffee shade trees escape attack, but *Albizia lebbeck* at present seems particularly susceptible, just as was Otaheite cane years ago. Blatchley & Leng (1916–619) quote from Hubbard that "a solitary female starts the galleries, in each of which five or six eggs are deposited. The young, hatching, feed upon the ambrosia which glistens on the walls like hoar frost. The pupae are formed lying free in the galleries, and in somewhat over a month from the egg the perfect beetles appear. In time, besides the mother, 15 or 20 offspring females have become adult, but only one or two males are commonly found. A second generation may be started, but usually the seasoning of the wood threatens failure of food fungus and the younger females depart to found new colonies in fresh tree tunks. Many kinds of trees are attacked: maple, orange, pine, oak and ash being especially mentioned by Hubbard," for Florida. In addition to sugar-cane, coconut palms, coffee shade trees and *Albizia lebbeck*, in Puerto Rico, interceptions of these beetles have been made from guava fruits at Cabo Rojo and orange fruit at Ponce by Mr. R. G. Oakley, from dry crotalaria pods, and at light at Mayagüez and Bayamón.

Xyleborus torquatus Eichhoff, another widely distributed neotropical shot-hole borer beetle, previously recorded from Puerto Rico, was identified

by Dr. W. H. Anderson as being probably the species principally responsible, with *X. affinis*, for killing the trees of *Albizia lebbeck* in the Río Piedras region in 1944–45.

Xyleborus amplicollis Eichhoff, the type from Puerto Rico, originally described in the Berliner Entomologische Zeitschrift (1868–280), has not since been found, either here or elsewhere.

Dr. M. W. Blackman identified the beetles intercepted by Mr. R. G. Oakley in orange fruit at Ponce as being a species of *Xyleborus* near *bispinatus* Eichhoff, this being a species known only from Brasil.

Xyleborus confusus Eichhoff occurs from Mexico southward thru Central America and all of tropical South American into Argentina, as well as in the West Indies, with records from most of the Lesser Antilles. As determined by Dr. W. H. Anderson, it was collected at light on Mona Island by Prof. J. A. Ramos (1947–44), the only record of a shot-hole borer from Mona. In Puerto Rico, beetles were collected from dying coconut palm trees at Cabo Rojo, as identified by Dr. A. D. Hopkins, and subsequent collections have been made from dead or dying palm trees at Camuy, San Lorenzo and Loíza, in no instance being associated with *Xyleborus affinis*. All stages, as identified by Dr. Hopkins, were present in great abundance under the bark and in burrows just underneath the bark of dead "bucare" (*Erythrina poeppigiana*) trees at Cayey. Dr. Donald De Leon collected an adult on the bark of a "moca" (*Andira jamaicensis*) tree at Ponce, and others have been intercepted in orange fruit at Aguadilla and at light at San Juan.

Xyleborus ferrugineus Fabricius "viene por la noche a las luces de las casas" in Puerto Rico according to Dr. Gundlach.

Xyleborus fuscatus Eichhoff, as determined by Dr. M. W. Blackman, was collected by Dr. Donald De Leon boring in the trunk of dead "almácigo" (*Bursera simaruba*) trees near Guayama.

Xyleborus grenadensis Hopkins, "at once distinguished from *affinis* by the shining declivity (but) nearly allied to *X. torquatus*," was found associated with *fuscatus* by Dr. De Leon in the dead trunk of "almácigo," and collected by him in abundance at light in the Guánica Forest, as well as high in the mountains at Maricao under the dead bark of "granadillo" (*Buchenavia capitata*).

Xyleborus inermis Eichhoff, listed by Mr. R. H. Van Zwaluwenburg (P.R. 810), and by Dr. Alex. Wetmore as eaten by the cliff swallow and the honey creeper, has subsequently been identified by Dr. M. W. Blackman from adults intercepted in mango at San Juan.

Coccotrypes bassiaevora Hopkins was identified by Dr. M. W. Blackman from beetles intercepted by Mr. R. G. Oakley in orange fruit at Ponce.

Coccotrypes rolliniae Hopkins was identified by Dr. M. W. Blackman

from beetles reared from the seeds of the palm *Neowashingtonia robusta* at Río Piedras by Mr. Francisco Seín. The type was from the seeds of *Rollinia octopetala* at Belém do Pará, Brasil.

Chalcohylus securigerus, described by Dr. M. W. Blackman as one of "New Genera and Species of Bark Beetles of the Subfamily Micracinae (Scolytidae, Coleoptera)" (Proc. U. S. National Museum, **29**, (3165): 341–365, pl. 2. Washington, D. C., 1943) on p. 364, is from a type intercepted by Mr. R. G. Oakley on dead wood at Yauco, P. R., and another from Haiti on "bois chandelle" (*Amyris balsamifera*).

Ambrosiodmus lecontei Hopkins was identified by Dr. M. W. Blackman from material collected by Dr. Donald De Leon at El Verde Camp, Río Grande, in dying terminals of "cedro" (*Cedrela mexicana*), and in dead twigs of "aceitillo" (*Zanthoxylum flavum*) at Maricao.

Of the beetles collected by Dr. Donald De Leon which Dr. Blackman did not assign to species are a **Pterocyclon** on "tabonuco" (*Dacryodes excelsa*), associated with a new species of **Ambrosiodmus**, at El Guineo Camp at Villalba.

Anisandrus sp. was the determination by Dr. M. W. Blackman of a beetle intercepted by Mr. R. G. Oakley in dead wood at Guayanilla.

Pycnarthrum sp. nov. was the determination by Dr. M. W. Blackman of beetles found by Dr. Luis F. Martorell breeding and boring in the bark of a recently cut tree of *Artocarpus communis* in Guajataca Gorge at Quebradillas.

Dendrosinus bourreriae, described by Dr. E. A. Schwarz as "A New Scolytid from Florida" (Proc. Ent. Soc. Washington, **22**: 220–26. Washington, D. C., 1920), was intercepted in orange fruit at Ponce by Mr. R. G. Oakley, as identified by Dr. M. W. Blackman.

Hexacolus sp. nov. was the determination by Dr. M. W. Blackman of beetles intercepted in a dead tree at Matrullas Dam by Mr. R. G. Oakley.

Platypodidae: Wide-headed Ambrosia beetles

Platypus compositus Say, a continental species of the southern United States, Mexico and Brasil, has been identified by Dr. M. W. Blackman from material collected by Dr. Donald De Leon from a log of "tabonuco" (*Dacryodes excelsa*) at El Guineo Camp, Villalba.

Platypus excisus Chapuis is a Central American species which Dr. M. W. Blackman identified from an abundance of beetles coming from blackened tunnels in logs of the coffee shade tree, *Inga vera*, at Aibonito.

Platypus poeyi Guérin-Méneville "talandra la madera en dirección de la corteza al corazón" according to Dr. Gundlach.

Beetles intercepted at light by Mr. S. D. Whitlock at Mayagüez were

identified by Dr. M. W. Blackman as a species of **Platypus** near **porrectus** Chapuis.

Platypus punctulatus Chapuis is recorded from Puerto Rico (Blackwelder 1947–790).

Platypus ratzeburgi Chapuis, as identified by Dr. A. D. Hopkins, has been found in great abundance coming from logs of the coffee shade trees, *Inga vera* and *Inga laurina*, from Lares and Ciales, and is presumably present thruout the coffee regions.

Platypus rugulosus Chapuis, a widely distributed continental species, from lower California to Argentina, was first identified from Puerto Rican material by Dr. A. D. Hopkins who examined beetles collected by Mr. Thos. H. Jones at light at Mameyes. It has since been intercepted at light at Mayagüez, in a grapefruit grove at Barceloneta and on flowers of *Inga vera* at Aibonito. Dr. Donald De Leon found it abundant at light at Guánica Forest, in broken limbs of "moca" (*Andira jamaicensis*) at Ponce, and in the mountains at El Guineo Camp, Villalba in logs of "tabonuco" (*Dacryodes excelsa*). It has been reared in large numbers from logs of "almácigo" (*Bursera simaruba*) at Camuy, and, judging by the number of records, is the most abundant of the Platypodid beetles in Puerto Rico.

Platypus schaumi, described from Puerto Rican material by Félicien Chapuis in his "Monograph des Platypides" (Memoirs de la Soc. Royale des Sci. Liege, **20:** 181, 1885 or 1886), has not since been found here.

Platypus subcostatus Jacq. DuVal, described from Cuba, is listed by Dr. Gundlach from Puerto Rico, but has not recently been found here.

Dr. Alex. Wetmore found that 41% of the stomach contents of the cliff swallow consisted of beetles of the genus *Platypus*. As many as 400 of these beetles were eaten at a single meal, and several birds had taken 200 or over. Near Aguadilla, in June, the swallows were capturing large numbers for their young, carrying them in the back of the mouth and below the tongue in a well-moistened mass." They form an important fraction of the food of the wood pewee and the green mango, and are also eaten by the black swift, the tody, the woodpecker, the honey creeper, and by the parula and black and white warblers. Lizards in coffee groves also eat these beetles emerging from coffee shade trees, dead, dying or cut for charcoal, and in the stomachs of *Anolis evermanni*, *Anolis stratulus* and *Anolis gundlachi*, the beetles have been found in considerable abundance. Whole beetles have been found embedded in amber in Hispaniola.

Curculionidae: Weevils

Artipus monae Wolcott, described ("IBSup" 1941–102) from weevils collected by Dr. Luis F. Martorell on beefwood (*Casuarina equisetifolia*) foliage on Mona Island, is "elongate oblong, piceous, everywhere densely

clothed with dull silvery scales, often tarnished to a faded brown in larger individuals." Prof. J. A. Ramos (1947–43) swept them in abundance from Sardinera and Uvero Beaches, and Dr. Martorell noted adults feeding on the foliage of *Amyris elemifera* in April 1944. It is quite possible that the same species is also present in Puerto Rico, specimens intercepted on leaves of castor bean at Ponce and on "mabí" at Mayagüez having been identified as a species of *Artipus* by Mr. L. L. Buchanan.

Lachnopus coffeae, long before it was named and described by Sir Guy A. K. Marshall among "Some Injurious Neotropical Weevils (Curculionidae)" (Bull. Ent. Research, **13** (1): 59–78, pl. 2, fig. 4. London, May 1922), was well known to coffee growers, and its injuries to the tender growth of coffee described by Don Guillermo Quintanilla as the "Enfermedad de los Cafetales en Adjuntas: La Plaga de la Vaquita" (La Reforma

Lachnopus coffeae Marshall, six times natural size. (Drawn by G. N. Wolcott.)

Agricola, año 3, No. 12, pp. 217–224. San Juan, November 1896), and by Mr. J. W. Van Leenhoff in the "Report of the Coffee Specialist" (*in* Ann. Rpt. P. R. Agr. Expt. Station for 1905, pp. 46–47. Washington, D. C., 1906). Mr. R. H. Van Zwaluwenburg, in discussing the "Insects Affecting Coffee in Porto Rico" (Jour. Ec. Ent., **10** (6): 513–17. Concord, December 1917), gives the most extended account up to that time, even noting the parasitism of its eggs by a Chalcid wasp, which was later very imperfectly described as *Tetrastichus vaquitarum* Wolcott. These shining, black and white beetles have the "integument piceous, with the legs, antennae and apex of rostrum reddish brown, clothed above and below with small, convex, shiny, subcircular or very shortly ovate, white scales, mostly not contiguous; the elytra usually with three very irregular transverse subdenuded patches. Length 5.5–6.25 mm., breadth 1.8–2. mm.," to quote from Sir Guy's original description. They occur thruout the lower

coffee regions, primarily feeding on the tender leaves of coffee, but have also been found eating tender orange and grapefruit leaves along the north coast, while Mr. R. G. Oakley intercepted them on chinaberry at Ponce. Even in captivity they may live nearly two months, the females laying small clusters of oval eggs glued between two leaves, from which maggots hatch in from ten to fourteen days. Falling to the ground, the grubs enter thru cracks and feed on the roots of plants. The appearance of the adults usually coincides with a flush of new growth on the coffee trees, so that despite the damage caused by them, it is quickly repaired and replaced with additional foliage. The application of arsenicals to these shiny tender leaves is hardly practical, and no attempt at control, even by hand picking, is normally attempted by coffee growers.

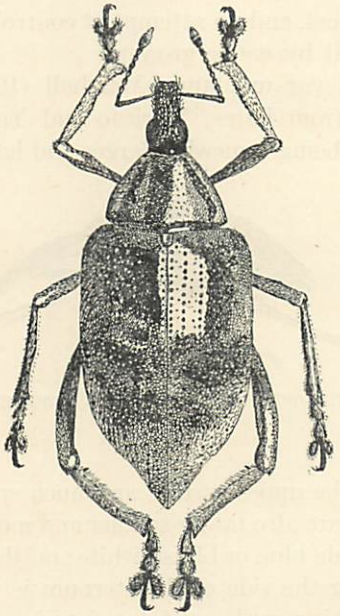
Lachnopus coffeae, var **montanus** Marshall (1922–62), the type from Indiera, equidistant from Lares, Maricao and Yauco, "differs from the typical coast form in being somewhat larger and having the legs markedly

Lachnopus coffeae var. *montanus* Marshall, six times natural size. (Drawn by G. N. Wolcott.)

paler; the scales on the upper surface are much sparser and more evenly distributed, and they are also rather smaller and more nearly circular; most of them being very pale blue or bluish white; on the other hand the stripe of white scaling along the side of the sternum is much denser and more sharply defined." This most beautiful variety is economically comparable to the coastal form, occurring in the coffee groves at the higher elevations, and having also been noted feeding on the tender leaves of *Cestrum macrophyllum* at Cialitos, and of *Isandrina emarginata* in the pass between Cayey and Salinas.

Lachnopus curvipes Fabricius is a considerably larger beetle than the endemic *coffeae*, and occurs also in Jamaica, Tortola of the Virgin Islands, and St. Barthélemy and St. Vincent of the Lesser Antilles. L. A. Auguste Chevrolat (1876–227) records the first collections by Dr. Stahl and Gundlach. One may presume that many of the records of this species being eaten by birds of the coffee groves and of the virgin forests, as recorded by Dr. Alex. Wetmore, include those of the at-that-time-undescribed *coffeae*. The birds noted are the cuckoo, ani, owl, kingbird, petchary, flycatcher,

mockingbird, vireo, parula warbler, honey creeper, yellow-shouldered black bird, oriole, mozambique, tanager, spindalis, grossbeak and grasshopper sparrow. The lizards *Anolis pulchellus* and *Anolis cristatellus* also feed on these weevils, as does also the introduced toad, *Bufo marinus*, but hardly in sufficient numbers to appreciably effect their abundance. The adults occur at all seasons of the year and in every part of the Island, with the possible exception of the higher mountains, feeding on a great variety of host plants, including such economic plants as cotton, orange, grapefruit, cabbage, swiss chard, watermelon, lima bean, and numerous weeds, bushes



Lachnopus curvipes F., six times natural size. (Drawn by G. N. Wolcott.)

and trees. The damage to most economic plants is negligible, but the attack of these beetles on the flowers and tender fruit of cultivated grape at Ponce in April 1939 was serious, and necessitated the immediate adoption of hand collection if any fruit was to be obtained.

Lachnopus kofresi Wolcott, described ("IPSup" 1941–104) from an abundance of material collected by Dr. Luis F. Martorell from the underside of the leaves of cultivated eggplant being grown at that time on Mona Island, has its integument entirely black, and has no scales, only short, silvery hairs on tibiae and tarsi. It is quite common on Mona Island, and adults have been found resting on the stems or leaves of numerous plants and shrubs.

Lachnopus seini Wolcott ("IB" 1936–302) is similar in size and appearance to *coffeae*, but is "entirely and evenly clothed with very small, convex, shiny, subcircular scales, with no constant areas of denudation," having been found feeding on the tender leaves of *Rapanea ferruginea* at Indiera, the type material collected by Mr. Francisco Seín, and subsequent collections on the same host made at Aibonito.

Lachnopus trilineatus Chevrolat (1876–228) was described from type material collected in Puerto Rico by Dr. Gundlach, of which no subsequent collection has been made.

Lachnopus valgus Fabricius is listed by Dr. Gundlach from Puerto Rico, but has not since been found here. The type is from St. Barthélemy in the Leeward Islands, and it is also recorded from Anguilla.

Lachnopus yaucona Wolcott ("IB" 1936–302) is somewhat larger than *coffeae*, its integument light brown, its scales light yellow in color, the type. material having been collected on *Rapanea ferruginea* at Indiera by Mr Francisco Seín in August 1933. No subsequent collection has been made.

Apodrosus argentatus Wolcott ("IP" 1924–130) has piceous to black integument, "evenly and closely covered with small, subcircular, silvery scales, interspersed, scantily on head, more thickly on prothorax, with black scales; length 4.0–4.5 mm., breadth 1.8–2.0 mm.," the type from *Dalbergia ecastophyllum* at Pt. Cangrejos, others on this host at Pt. Salinas, Mameyes and Boquerón. Its habitat is the beaches of Puerto Rico and Mona Island, adults having been found in abundance on "abeyuelo" (*Colubrina ferruginosa*) at Guánica and on Mona; intercepted on "mabí" (*Colubrina reclinata*) at Mayagüez, on tamarind and *Peiranisia* at Ponce by Mr. R. G. Oakley, noted feeding on the leaves of "mangle botón" (*Conocarpus erecta*) at Faro de Cabo Rojo, and of "guayacán" (*Guaiacum officinale*) at Guánica and Salinas.

Apodrosus wolcotti Marshall (1922–59), "fairly closely covered above with small, nearly circular, pinkish-bluff scales having a distinct coppery sheen," was found feeding on the leaves of the coffee shade tree (*Inga vera*) at Río Piedras, and since noted on this host at Cayey, and intercepted on the flowers of *Inga laurina* at Adjuntas. It has also been intercepted on vanilla at Adjuntas, but is most often noted resting on coffee leaves: at Añasco, Indiera, Maricao, Jájome Alto and Manatí.

Compsus maricao Wolcott ("IP" 1924–125), has "integument shining black, densely clothed, except for denuded areas and ridges, with light blue-green scales; length 13.0 mm., breadth 4.5 mm.," the type a single female from Maricao which had just laid eggs between coffee leaves. Mr. R. H. Van Zwaluwenburg had previously collected a specimen in the mountains above Mayagüez which he had presented to the U. S. National

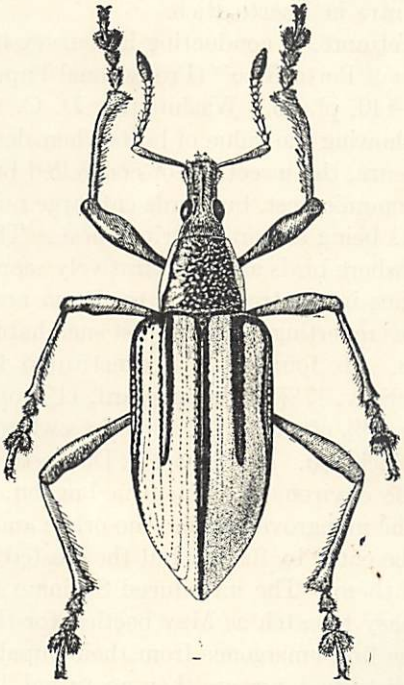
Museum. Recently others have been found: resting on *Eugenia* at Jayuya, and feeding on the leaves of *Cecropia peltata* at Villalba.

Compsus luquillo sp. nov., differs from *maricao* in the color of scales, which are bright yellow in living material, becoming somewhat greenish in museum specimens, and most noticeably in that the median denuded ridge on each elytron extends less than half-way to the base. Near the apex it is joined by a curving lateral ridge extending to the base, where it is joined by a short submarginal ridge. *Compsus maricao* has three parallel ridges extending from the base of the elytron to apex, and one short submarginal ridge. Both are similar in general appearance to *Compsus zebra* Marshall (1922–199) from Colombia, but the dorsum of the prothorax of the Puerto Rican species is broadly and deeply concave and undenuded, while the sutural margin of the elytra is elevated and denuded; quitethe reverse of the apparent contour of *zebra*. The largest specimen of *maricao* measures 13.0 mm. in length; the smallest specimens of *luquillo* somewhat exceed this, the type is 18.0 mm. long, collected feeding on the leaves of "camasey" (*Miconia prasina*), at El Verde Camp, Río Grande, August 22, 1947, one of a pair; three others on the same host at the same locality, July 4, 1946. Admittedly, the differences between *Compsus maricao* and *Compsus luquillo* are no greater than between the named extreme forms of *Diaprepes abbreviata* L., but the variations in *Compsus* correspond to the distinct geographical regions after which they are named, and, to date, no intermediate has been found.

Diaprepes abbreviata Linnaeus, after the statement of Sir Guy A. K. Marshall (1915–627) "is not only the older and therefore more correct name, but is also in general use in the West Indies," has been generally accepted as the name to be applied to the common "vaquita" of Puerto Rico: the sugar-cane root-stalk borer weevil. Dr. Stahl calls it *Prepodes doublieri* Guerin; Dr. Gundlach follows Chevrolat (1876–227) in listing *Diaprepes distinguendus* Boheman as not in synonymy with *Diaprepes comma* Boheman; and Dr. W. Dwight Pierce in his beautifully illustrated paper on "Some Sugar Cane Root-Boring Weevils of the West Indies" (Jour. Agr. Research, **4** (3): 255–271, pl. 5. Washington, D. C., June 15, 1915) calls the "weevil root-borer" of sugar-cane in Puerto Rico *Diaprepes sprengleri* Linnaeus, of which he recognizes three varieties: *abbreviatus* Olivier, *comma* Boheman and *sprengleri* Linnaeus, separable on the basis of scale coloration and denuded elytral ridges. Economically at least, the "vaquita" is but a single species: a large, black, leaf-feeding weevil, attractively scaled with white, cream, yellow, pink or chestnut, of which the larvae bore in the root-stalk of sugar-cane or the roots or tubers of many other hosts.

The variation in the scale coloration and the extent of denudation of the

elytral ridges of the adults of *Diaprepes abbreviata* may be only a reflection of the variation in duration of the stages of the immature forms resulting from intense parasitization by *Tetrastichus haitiensis* Gahan of the eggs which are laid normally in late spring. Indeed, so few grubs survive from egg-clusters laid in May and June, when the parasite is most abundant, that it would appear that the weevil primarily owes its survival to the eggs laid by a comparatively few exceptional and abnormal females emerging from the ground at other times of year when the parasite is scarce or absent.



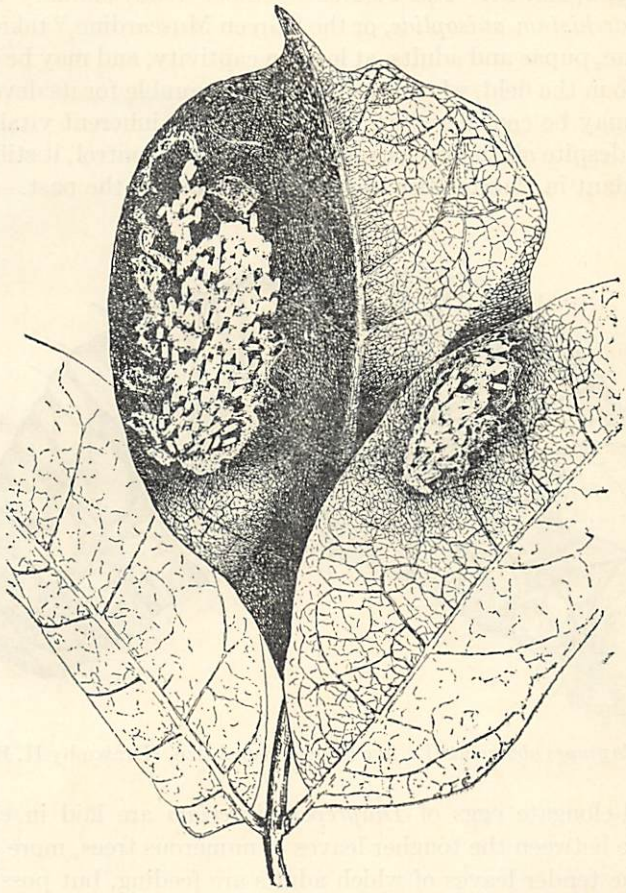
The Sugar-Cane Weevil Root-Stalk Borer, *Diaprepes abbreviata* L., five times natural size. (Drawn by H. Bradford.)

Despite the most intensive investigations on "The Sugar Cane Weevil Root Borer" (Bulletin No. 14, Insular Expt. Station, Río Piedras, pp. 19, fig. 11. San Juan, April 14, 1915) by Mr. Thos. H. Jones, this parasite was not found by him in Puerto Rico at that time, but awaited discovery in Haiti, reared from the egg-clusters of the quite similar *Exophthalmus quadrivittatus* Olivier, in 1928. Dr. Herbert Osborn Jr. found that this *Tetrastichus* was abundant in Puerto Rico, not only being present in egg-clusters laid between the leaves of "jagüey" (*Ficus stahlii*) growing along the margins of certain fields of Central Aguirre at Santa Isabel, where he

made his first collections in 1932, but generally thruout the Island. In conducting "The Citrus Pests Investigation in the Windward & Leeward Islands, British West Indies, 1937–1942" (Imperial College of Tropical Agriculture, pp. 66, pl. 2, ref. 20. Port-of-Spain, August 1942), Mr. R. G. Fennah found this and *Tetrastichus marylandensis* Girault present in many of the Lesser Antilles. Neither occurs in Barbados, but attempts at introduction from Puerto Rico failed because the female parasite was unable to parasitize the eggs when laid between the tough tips of cane leaves; an almost universal place of oviposition by *Diaprepes* females there, but comparatively rare in Puerto Rico.

Dr. Alexander Wetmore, in conducting his survey of the economic food habits of the "Birds of Porto Rico" (Professional Paper, Bulletin No. 326, U. S. D. A., pp. 1–140, pl. 10. Washington, D. C., 1916), was possibly most successful in showing the value of birds when dealing with *Diaprepes abbreviata*. To be sure, the insect is not controlled by birds, otherwise it would not be an economic pest, but birds eat large numbers of adults and certainly prevent its being a more injurious pest. The weevils occur not only in cane fields, where birds are comparatively scarce, but more abundantly in field margins, in the trees along roadways and on forest margins, or in upland pastures reverting to forest, just such habitats as are preferred by most land birds. He found that it constituted 18% of the stomach contents of the petchary, 17% of the kingbird, 11% of the flycatcher, 10% of the mozambique, 7% of the ani, 2% of the owl and nearly 2% of the yellow-shouldered blackbird. Dr. Stuart T. Danforth noted the abundance of the beetles in the environs of Cartagena Lagoon, and that they were eaten by the owl, the mangrove cuckoo, the oriole and the ani. They are somewhat large to be eaten by lizards, but the crested lizard, *Anolis cristatellus*, eats many of them. The introduced Surinam toad, *Bufo marinus*, finds them not as easy to catch as May beetles, for they do not return to the ground after the first emergence from their pupal cell, and fall to the ground only when disturbed, nor are they nocturnal, like the May beetles. At periods when May beetles or other black Scarabaeid beetles are abundant, the toads concentrate of these more readily available items of food, but at other times they may eat considerable numbers of vaquitas. No such notable reduction in the abundance of *Diaprepes* followed the introduction of the toad as was the case for May beetles, however, indicating the comparatively minor role played by the toad in their natural control. Nevertheless, coincident with the scarcity of toads in the last few years, such large numbers of *Diaprepes* grubs occurred in some fields on the south coast during 1948 and 1949 as to cause serious losses. Large amounts of crude benzene hexachloride containing 12.5% of gamma isomer were applied in some of these fields at the rate of eight pounds per acre. This

amounts to only one pound per acre of gamma isomer, an amount insufficient to kill grubs, in any stage of growth. White grubs are somewhat more susceptible to the new insecticides than are the legless *Diaprepes* grubs, and for heavy infestations of large grubs in the soil, not less than

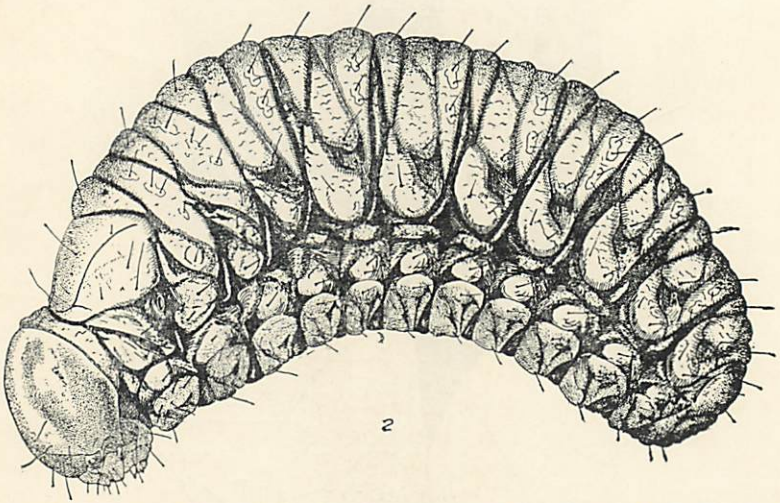


Egg-clusters of *Diaprepes abbreviata* L., between leaves of "jobo" (*Spondias mombin*), twice natural size. (Drawn by Francisco Seín.)

two pounds per acre of aldrin or two pounds of lindane must be used. Preliminary tests indicate that *Diaprepes* adults are readily killed by spraying infested host trees with 1% chlordan or 1% dichlorodiphenyldichlorethane (DDD), and it may be presumed that several of the other new insecticides will prove equally or even more effective. Infested citrus trees should not be sprayed with DDT however, as by destroying scale insect parasites, the eventual result is a mass infestation by scale insects

made more difficult to control because biological control has ceased to function.

As was abundantly proved in working out "The Life History of *Diaprepes abbreviatus* L., at Río Piedras, Puerto Rico" (Jour. Agr. Univ. P. R., **20** (4): 883–914, fig. 5, ref. 21. Río Piedras (October 1936) January 1937), the fungus *Metarrhizium anisopliae*, or the "Green Muscardine," takes a heavy toll on larvae, pupae and adults, at least in captivity, and may be presumed to do so also in the field, when conditions are favorable for its development. Indeed, it may be considered an indication of the inherent vitality of the insect that despite all the various factors of natural control, it still seems to be as abundant in Puerto Rico now as at any time in the past.

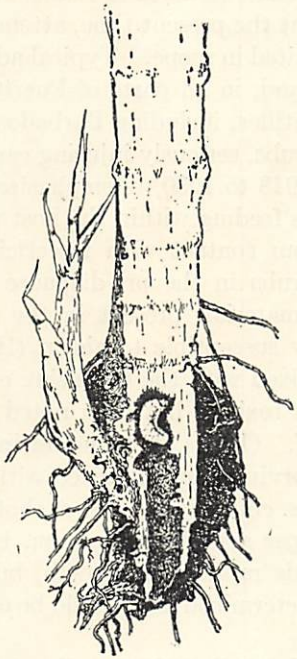


Larva of *Diaprepes abbreviata* L., five times natural size. (Drawn by H. Bradford.)

The oval-elongate eggs of *Diaprepes abbreviata* are laid in clusters of varying size between the tougher leaves of numerous trees, more especially those on the tender leaves of which adults are feeding, but possibly quite as often between the leaves of trees uneaten by adults. Comparatively rarely in Puerto Rico are the eggs laid between the split tips of the leaves of sugar-cane, but as suggested by Mr. Fennah, that "Otiorhynchids Oviposit between Paper" (Jour. Ec. Ent., **26** (6): 1172–3. Geneva, December 1933) indicates that "places for egg-laying are chosen on account of their physical attributes of flatness, stiffness, and opposability of plane surfaces." A thin film of sticky, transparent plastic surrounds the cluster on all sides, holding the two opposed leaves together no matter how slippery they may be, but as this film hardens, it loses much of its sticking power, enabling the

hatching grubs to escape from between the leaves upon hatching. It is such a powerful adhesive, however, that when the eggs are laid between paper, chosen in preference by the females rather than any kind of leaves, the grubs can not escape. This suggests a method of partial control that might prove practical in a young citrus nursery.

The variability in behavior essential to survival is at once displayed by the grubs in "The Larval Period of *Diaprepes abbreviatus* L." (Jour. Dept. Agr. P. R., **17** (3): 257–64, pl. 1, ref. 2. San Juan, November 14, 1933),



Larva of *Diaprepes abbreviata* L., in rootstalk of sugar-cane, one-half natural size. (Drawn by Francisco Seín.)

and more noticeably in "The Diapause Portion of the Larval Period of *Diaprepes abbreviatus* L." (Jour. Agr. Univ. P. R., **18** (3): 417–28, fig. 2, ref. 1. Río Piedras, October 27, 1934). Altho most often noted boring in the root-stalks of sugar-cane, the grubs have been found in the tubers of "ñame" and "yuca," in seed corn just beginning to sprout, and in the tap-roots of seedlings of pepper, papaya, grapefruit and mahogany. It may be presumed that they feed on any kind of live roots or tubers available, by preference chosing those of sufficient size that they may bore within them, rather than feeding from the outside, as do white grubs.

The adults feed on the leaves of sugar-cane, cotton, citrus, coffee and all

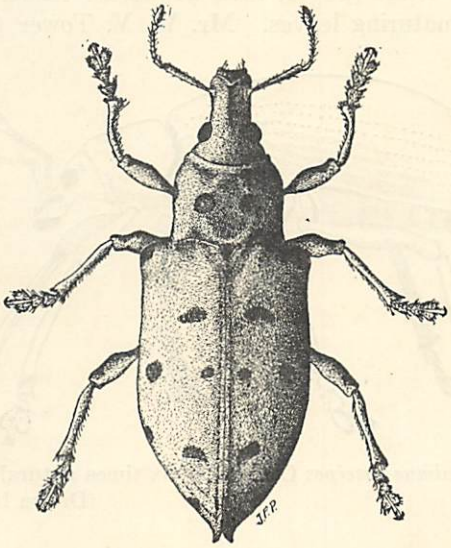
kinds of native and imported vegetables, as well as of practically every endemic and foreign tree. Those feeding on leaves sprayed with arsenicals or barium fluosilicate may be killed, but the effect of DDT is mostly as a repellent, causing them to chose some other unsprayed tree on which to rest, copulate and feed. Handpicking from pigeon pea bushes planted between cane fields is extensively practised in Barbados, but is hardly practical in Puerto Rico, where so many other kinds of vegetation offer equally attractive shelter for the adults. Hand collection of the grubs was at one time extensively attempted at Guánica in connection with the hand collection of white grubs, but at the present time, attempts at control in Puerto Rico are sporadic and limited in scope. Typical adults have been collected in Hispaniola, Mona Island, in all parts of Puerto Rico, on Vieques and in most of the Lesser Antilles, including Barbados.

Recent outbreaks of grubs, seriously injuring cane fields on the east and southern coasts during 1948 to 1950, re-emphasized the need for effective chemical control. Grubs feeding within the host plant are naturally protected by its tissues from contact with insecticidal chemicals, and the migrating fully-grown grubs in the pre-diapause period are remarkably resistant to extraneous materials present in the soil. The just-hatched grubs, however, are very susceptible to aldrin (Hyman 118), as little as half a pound per acre mixed with the soil being effective in killing them, and no diminution in its toxicity has been noted after being mixed with soil for a year and a half. Others of the newer insecticides are much less toxic, *Diaprepes* grubs surviving in soil mixed with 2 lbs. of chlordan, but not with as much as 5 lbs. chlordan, 10 lbs. of rhothane (DDD), or 20 lbs. of DDT. Ten pounds per acre of the gamma isomer of benzene hexachloride somewhat retards rapidity of growth, but the amount requisite for control has not been determined, and would be commercially impractical for commercial use.

Diaprepes capsicalis Marshall (1922–59), listed also by Dr. Blackwelder (1947–803) as an *Exophthalmus*, has the "integument black or piceous, fairly densely clothed above and below with brown or brownish-grey scaling, often with a coppery reflection; elytra with a pale dot about the middle of interval five. Length, 8–12 mm." It has been found only in Puerto Rico. Described from material collected by Dr. Richard T. Cotton at Río Piedras feeding on the foliage of garden peppers, it is possibly more abundant in the mountains, having been noted eating "fresas," the fruit of *Rubus rosaefolius*, at Jájome Alto, and also on the ground under fresa bushes at Jájome Alto a year later; on the ground in a sweet potato field being plowed at Cidra; intercepted at Jayuya, and on carrots at Villalba. Concerning a long series of unlabeled specimens in the collection at Río Piedras, one can only surmise as to the identity of the collector and the data of their collection. In the stomach contents of an ani, shot at La

Florida by Dr. Luis F. Martorell, was found the remains of one of these beetles.

Exophthalmus quindecimpunctatus Olivier (1807–300), described from Puerto Rico and known only from there, listed by Chevrolat (1876–227) and by Drs. Gundlach and Stahl as a *Prepodes*, was first noted in recent times by Dr. Luis F. Martorell in August 1940 eating the foliage of "corcho prieto" (*Torrubia fragrans*), on the mountain road to Maunabo from his home town of Yabucoa, and subsequently found in even greater abundance in October and December of the same year on the same host. It is quite possible that Olivier had but a single specimen in hand when preparing his

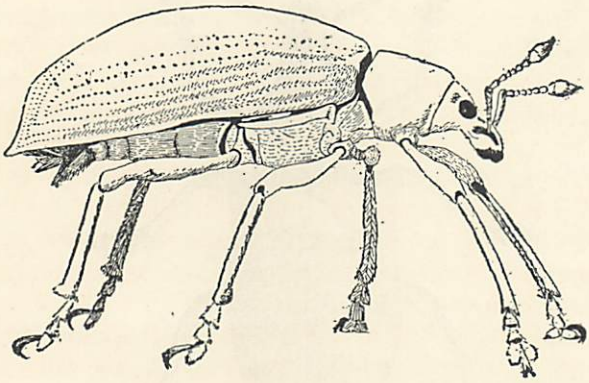


The Corcho Prieto Weevil, *Exophthalmus quindecimpunctatus* Olivier, four times natural size. (Drawn by José F. Pietri.)

description, for the number of spots varies depending on the amount of denudation of the beautiful iridescent metallic green scales from the black integument. Four black spots are usually to be noted on the prothorax, two above and one at each side; on each elytron are from five and one-half to eight and one-half, each spot quite round and distinct if present at all. Host trees have a much wider distribution in Puerto Rico, but no beetles have been found on trees at other points on the Island, except most recently at the mountain pass of El Collao, between Cayey and and Salinas, thirty miles distant from Yabucoa.

Exophthalmus roseipes, described by L. A. Auguste Chevrolat (1876–ccxxvii) as a *Pachnaeus* and thus listed by Drs. Stahl and Gundlach, is another even more beautiful endemic weevil, found nowhere else than in

Puerto Rico. Unrubbed specimens are completely covered with light Niagara green scales; beneath and on antennae and legs silvery white, with the integument of the legs possibly sufficiently light-colored and roseate to merit the specific name given by Chevrolat. The beetles are lighter in color than the very tenderest of the citrus leaves on which they are most often noted feeding, and on which they may at times become an economic pest, but also occur on the leaves of such other beach shrubs as seagrape and icaco, and are possibly a most perfect match on the more tender leaves of *Dalbergia ecastophyllum*. Adults in captivity eat their own weight of leaves daily, thus despite their comparatively small size, when at all abundant in citrus groves, their attack on tender leaves becomes noticeable in the maturing leaves. Mr. W. V. Tower (1911–9) records



Exophthalmus roseipes Chevrolat, six times natural size.
(Drawn by G. N. Wolcott.)

their scarring of young fruit, but this is exceptional, and only their very exceptional abundance would justify spraying with arsenicals or DDT to prevent attack. Dr. Wetmore found none of these beetles eaten by any of the birds he collected, but they doubtless do form an important item in birds, food at the seasons when they appear. Mrs. Raquel Dexter (1932–5) found them eaten by the introduced toad, and they are unquestionably eaten by the lizards inhabiting citrus trees in sandy areas, or beach shrubbery.

Hylobius pales Boheman, as identified by Dr. E. A. Chapin, was intercepted in a room in San Juan. This is not a tropical insect, being found from Nova Scotia west to Lake Superior and south to Florida, adults living in and beneath the bark of pine trees, the larvae destroying the inner bark and the tender, newly-formed wood beneath.

Heilipus ustulatus, described from Puerto Rico by Antoine G. Olivier

(1807–198) and not since found elsewhere, was not listed by Drs. Stahl or Gundlach.

Anchonus suillus Fabricius, described originally from the Island of St. Barthélemy, was listed by Dr. Gundlach from Puerto Rico, and has been found since all around the Island, under boards or decaying wood on the ground. When collections of *Cosmopolites sordidus* were being made at Río Piedras from slices of banana corms, these dirty, black beetles were often found accompanying the larger, shiny black ones. Presumably they are more abundant than the scarcity of records would indicate, for they were found by Mrs. Dexter to have been eaten by the introduced Surinam toad, and they have also been found eaten by the crested lizard, *Anolis cristatellus*, and by the introduced bullfrog, *Rana catesbeiana*.

Genonotus angulicollis, described as an *Anchonus* by L. A. Auguste Chevrolat (1876–ccxxviii) from Puerto Rico, and not since found elsewhere, was listed by Dr. Gundlach. The punctures on its elytra alternate with elongated warts with erect reddish-brown elongate scales; prothorax, beak and legs consist entirely of closely-set punctures. It has been found under the loose bark of a coffee shade tree, *Inga vera*, at Cayey, and under the dead bark of a tree on El Yunque.

A beetle identified as a species of **Sternechus**, as identified by Mr. L. L. Buchanan, was intercepted by Mr. R. G. Oakley on *Casearia* at Ponce, and others intercepted by him at Ponce on pomarrosa and on *Senegalia* flowers as species of **Smicronyx**.

Derelomus albidus, a Cuban weevil described by Suffrian, was listed from Puerto Rico by Dr. Gundlach. What may be the same was listed as a species of *Phyllotrox* from Puerto Rico by Dr. Alex. Wetmore as having been eaten by the "reinita" or honey creeper, *Coereba portoricensis*.

Cylas formicarius Fabricius, "el Piche de la Batata," occurs in all of the Greater Antilles and India, but to date, not in the Lesser Antilles. It is unquestionably the most serious pest of sweet potatoes in Puerto Rico, causing many tubers to be unsalable in the market if at all infested, and rejected for food for either man or beast if the infestation is at all general. Because the yellow, sweeter and more palatable varieties are greatly preferred by the piche, the general public, in purchasing the tubers in the market in quantities, discriminates against these more desirable kinds and accepts for human food the tougher, white varieties which are less nourishing because they contain less of carotine and consist mostly of fiber. The older and larger subterranean stems of the goat's foot morning-glory, a common weed tying together the sand on all beaches not regularly invaded by high tides, is also infested by the piche, making doubly difficult any attempt at control. The primary reason, however, why control is so difficult is that the bulk of sweet potato production is by small farmers, who

use the field as a storehouse of unharvested food, taking from it the larger tubers only as needed, and finally abandoning the field when most of the tubers are too badly infested. So far as known, the piche has no natural enemies and certainly no specific parasites.

The adults developing from several larvae in a single tuber need not even leave its protection to mate and continue a second generation, until it is completely destroyed by the feeding tunnels. Dr. Richard T. Cotton observed "*Cylas formicarius* Fabr. in Flight" (Jour. Ec. Ent., **9** (5): 516. Concord, N. H., October 30, 1916) in moving streetcars at night, and it had been previously noted at light in Río Piedras as early as 1912. When exceptionally abundant, adults may swarm in fields of sweet potatoes, eating stems, midribs and the larger leaf veins, and under such conditions are readily killed by the application of arsenicals or other insecticides. Normally, however, adults are rarely seen above ground. They attack roots or fresh tubers beneath the surface of the soil, gaining access by means of cracks. If carefully selected slips, free from infestation, are planted, these may escape early infestation if rainfall is abundant, but the effect of drought on the heavier soil is to produce cracks giving ready access for the weevils. Sandy soil is less subject to cracking during drought, and plantings of sweet potatoes on such soil are less subject to early infestation. In all cases, however, early harvesting of the tubers as soon as they have matured is advisable, while the prompt destruction of infested culls will do much to prevent infestation of the succeeding crop. The real problem in control in Puerto Rico is how to apply known measures of repression to the actual conditions of field practise, for as long as sweet potatoes are grown mainly as a subsistence crop by small farmers, effective control of the piche is impossible. The scientific specific name of the weevil is most appropriate, for the adults are definitely ant-like in appearance, with shining metallic blue elytra, black head, constricted prothorax and legs of chestnut red.

Apion martinezi Marshall (1935–516) was originally described by Sir Guy A. K. Marshall under the name *Apion xanthoxyli* (preoccupied by *xanthoxyli* Fall in Texas) as one of "New West Indian Curculionidae (Col.)" (Annals and Magazine of Natural History, **14** (10): 621–631. London, December 1934), the type from Guánica Forest, reared from seeds of West Indian satinwood or "aceitillo" (*Zanthoxylum flavum*), by Oscar R. Torres. It was found to be almost equally abundant by E. Martínez in the seeds from another aceitillo tree at Camp Buena Vista, Maricao, elevation 2700 feet. The integument of these beetles is red-brown, above with yellow-brown scaling, varying or interspersed with grey or whitish scales, below with whitish scales; length 2.0 mm., width 1.1 mm. For the foresters attempting to propagate aceitillo, this is a very serious pest, for from nearly half to sometimes all the seed is destroyed by the larvae burrowing in it.

Of the habits of the adults, nothing is known. The seed-producing trees are too high to be sprayed by any equipment locally available, and no attempt at control has been made.

Apion subaeneum, described by Carl E. A. Gerstaecker, the type from Puerto Rico, is synonymous with his **portoricanum** (Stett. Ent. Zeit., **15** 234–261, 265–280. Stettin, 1854). Mr. L. L. Buchanan is of the opinion that the *Apion* beetles intercepted by Mr. R. G. Oakley at Ponce, on flowers of the euphorbia "escambrón" (*Ricinella*) and on leaves of *Peiranisia* is of a different species from either of these.

Euscelus bipustulosus Jekel (1860–214), originally described as an *Attelabus* from Jamaica, is the determination of Dr. W. Dwight Pierce of the weevil leaf-roller of guava in Puerto Rico. As *Attelabus sexmaculatus*

The Guava Leaf-Roller, *Euscelus bipustulosus* Jekel, six times natural size. (Drawn by G. N. Wolcott.)

Chevrolat (1876–ccxxviii), the type from Puerto Rico presumably collected by Dr. Gundlach, it was listed by him and Dr. Stahl, and in Van Zwaluwenburg's list (P. R. 1024) feeding on *Psidium guajava* and *Eucalyptus*. Both specific names are equally applicable to these shining, reddish-brown weevils with spined and greatly expanded front femora, for they have two prominent golden pustules near the base of the elytra, and two additional golden spots laterally on each elytron. They occur in all parts of the Island where guava bushes grow, pairs coöperating in cutting strips of leaf tissue from the more tender leaves and rolling the strip up around the single egg until it forms a compact surrounding of nourishment for the larva. The egg is parasitized by *Poropoea attelaborum* Girault, a Trichogrammid wasp known only from rolls of these weevils. Altho guava foliage is normally preferred by these weevils, in nurseries of young eucalyptus, they may at times be-

come a serious pest, outbreaks having been noted on *Eucalyptus robusta* at Guavate, Cayey and at Patillas in 1940 and on *Eucalyptus citriodora* at Cayey in the same year. The tender leaves of the "almendro" (*Terminalia catappa*) have also been noted attacked at Río Piedras and at Bayamón.

Euscelus coccolobae Wolcott was described as an *Attelabus* ("IP" 1924–123) from paired adults which were feeding on and forming rolls of leaf tissue of seagrape (*Coccoloba uvifera*) about individual eggs, at Pt. Salinas. It is quite common on seagrape on all beaches, and on the leaves of "cucubano" (*Coccoloba laurifolia*) and "moralón" (*Coccoloba grandifolia*) in the interior of Puerto Rico. Shining, robust, dark purplish-red, their elytra with rows of deeply-impressed, quadrangular punctures, this Puerto Rican pest of seagrape differs from the Hispaniolan *armatus* Gyllenhal of seagrape most obviously in its blunter tooth posterior of the smooth area on the humerus. With stout, toothed femora and long, curved tibiae of the forelegs, they are well-fitted physically for rolling up a long strip of seagrape leaf tissue about the egg, the male and female working together to hold the strip tight until the drying of the tissue sets it in the desired position. They make no attempt to utilize the tough, older leaves, and even the tender tissue must be of just the right stage of pinkish-green tenderness for manipulation by the beetles. The leaf-rolls remain attached to the leaf indefinitely. Strips may dry too rapidly at mid-day and have to be abandoned, but at sunset so slowly that darkness sometimes overtakes the beetles still at work.

Myrmex pulicarius Boheman (1843–207), described as an *Otidocephalus*, the type from Puerto Rico, has been intercepted on "musgo" (*Pilea tenerrima*) at Adjuntas and on guava at Arecibo.

Anthonomus pulicarius Boheman (1843–219), the type from Puerto Rico, but found also in Hispaniola, is a minor economic pest, Mr. R. H. Van Zwaluwenburg (1916–45) noting it as "a very small, dark, long-snouted weevil in the flower buds of egg-plant." Dr. Richard T. Cotton (1918–300) naming it the "Eggplant Bud weevil," observed that it "feeds on leaves and breeds in the flower buds. Eggs are laid in young developing buds and the small white legless larvae develop within the bud, causing it to dry up and drop off." Control is more difficult because wild eggplant (*Solanum torvum*) may also be infested, but fortunately the insect is normally not very abundant, despite occurrence in all parts of the Island.

Anthonomus annulipes Fisher was described from Puerto Rico (1888–488), and listed by Dr. Gundlach, but has not been identified from local material since.

Anthonomus dentipennis Chevrolat, the type from Puerto Rico (1876–ccxxviii), probably collected by Dr. Gundlach, was listed by him with *A. krugi* Fisher (1888–487) in synonymy. Weevils doubtfully identified by

Mr. A. J. Mutchler as being this species were collected by Dr. Stuart T. Danforth at Boquerón.

Anthonomus costulatus Suffrian, described from Cuba and found also in southern Florida, has been repeatedly intercepted on guava: at Adjuntas, Aibonito and Río Piedras, as identified by Mr. L. L. Buchanan.

Anthonomus flavus Boheman, the type from Guadeloupe, was identified by Mr. L. L. Buchanan as being the minute grey weevil reared by Mr. A. G. Harley at Mayagüez from the bright red cherries of *Malpighia glabra*. To what are presumably identical specimens, swept from foliage of the West Indian cherry, *Malpighia punicifolia* L., at Río Piedras, he gives only the generic name. The injury produced by the development of the immature stages of this weevil in the fruit resembles that caused by the plum curculio: a crescentric russeting scar on the skin and puckering of the flesh underneath. Oviposition has not been observed, but the maggot confines its feeding to one area, and the pupa is formed in a chamber close to the seed. The first indication of transformation to adult is the conspicuous blackening of the eyes.

Anthonomus nigrovariegatus Fisher, the type from Puerto Rico (1888–488), probably collected by Dr. Gundlach, has not since been identified.

Besides these named species of **Anthonomus** known to occur in Puerto Rico, extensive interceptions, especially by Mr. R. G. Oakley in the Ponce region, have accumulated material in the U. S. National Museum of which Mr. L. L. Buchanan recogniżes eighteen undescribed species. Apparently none is of economic importance, and none has been noted on cotton. The Mexican cotton boll weevil, *Anthonomus grandis* Boheman, found also in Central America, the southern United States, Cuba, and most recently in many sections of Haiti, is unknown to date in Puerto Rico.

Weevils intercepted by Mr. R. G. Oakley on flowers of "guácima" (*Guazuma ulmifolia*) at Ponce, and on flowers of the coffee shade tree (*Inga laurina*) at Adjuntas, were identified by Mr. L. L. Buchanan as a species of **Neomastix**.

Piazorrhinus sp. was the identification by Mr. L. L. Buchanan of weevils intercepted by Mr. R. G. Oakley at Ponce and Yauco.

A species of *Tychius* was listed by Dr. Alex. Wetmore as having been eaten by the cliff swallow.

Weevils intercepted at Ponce by Mr. R. G. Oakley on flowers of "escambrón" (*Randia mitis*) and of an "acacia" (*Senegalia*) were identified by Mr. L. L. Buchnan as a species of **Sibinia**, others from Ponce and Aibonito as a species of **Pyropus**, and some from *Ocotea* fruit at Adjuntas as a **Conotrachelus**.

Chalcodermus ebeninus Boheman is an entirely black, deeply punctured weevil first found on cowpeas at Río Piedras in 1912 by Mr. Thos. H.

Jones, of which identification was made by Dr. E. A. Schwarz. It was listed by Mr. R. H. Van Zwaluwenburg (1513), but this refers to the Río Piedras record, and the insect seems to be localized, normally not abundant, yet at times so numerous that half the cowpeas will be infested of those harvested from a single field. Because of its normal scarcity, no precautions are taken to prevent infestations of succeeding crops, and ordinarily none is necessary.

Chalcodermus pupillatus Suffrian is a Cuban weevil first reported from Puerto Rico by Dr. Alex. Wetmore, having been found by him eaten by the mozambique. Dr. Stuart T. Danforth found it eaten by the pewee, and he had numerous specimens, as determined by Mr. A. J. Mutchler, collected at Mayagüez, Boquerón, Cabo Rojo, Yauco and Cartagena Lagoon. A weevil intercepted by Mr. R. G. Oakley on cotton at Ponce was identified by Mr. L. L. Buchnan as being a different species of *Chalcodermus* from either of these two named species.

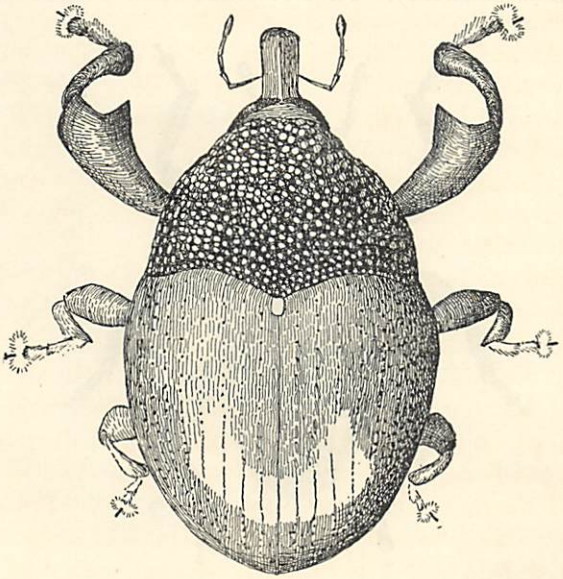
A species of **Rhyssomatus** was reported by Dr. Alex. Wetmore as being eaten by cuckoos and the ani, and specimens were intercepted on *Peiranisia* at Ponce by Mr. R. G. Oakley.

Nettarhinus mannerheimi was described by Francis P. Pascoe (1844–30) from Puerto Rico.

Pseudomopsis cucubano sp. nov., is oval, yellowish fawn to dark brown, length 5.0 mm. width 3.0 mm. Beak somewhat curved, shining, reddish brown, tending to become scaly and roughened towards the base (as is the head), in repose sunk deep in pectoral grove extending into the metasternum; antennae slender, elbowed, the scape as long as segments two and three combined, club elongate oval, the segmentation not marked. Eyes contiguous in front, coarsely faceted, in repose apparently subtriangular, partly covered behind. Circular light grey scales thickly, evenly but with no systematic arrangement cover the dark brown prothorax, wider than long but not as wide as elytra. Scutellum light grey, small but prominent. Elytra oval, narrowed towards base, yellowish fawn, irregularly darker towards margins; intervals 1 to 5 with whitish postmedian bands forming a crescent, broadest towards points. Intervals level, striae distinct, punctures near base as far apart as width of intervals, closer approaching apex. The first ventral segment of the abdomen most widely separates the coxae of the hind legs, its width equal to that of the next three combined and somewhat more than that of the fifth, all with light grey scales except apex of fifth, pygidium not exposed. Front femora prominently toothed. Described from six adults, reared from infested seeds of "cucubano" (*Coccoloba laurifolia*) or "ortegón" (*Coccoloba borinquensis*) at Garrochales (Arecibo), collected December 16, 1943 by Mr. José Marrero, the adults beginning to emerge from the seeds about March 20,

1944; generic determination by Mr. L. L. Buchanan, P. R. Acc. No. 112–44, other specimens in the U. S. National Museum intercepted by Mr. R. G. Oakley on *Coccoloba laurifolia* at Yauco and Ponce, not seen in preparing the description.

Pseudomus militaris, described as a *Rhynchaenus* by A. G. Olivier ("Entomologie" V. No. 83, p. 145. Paris, 1807), the type from Puerto Rico, has not since been collected, but weevils of this genus, as identified by Mr. L. L. Buchanan, have been collected on El Yunque by Dr. Luis F. Martorell, and intercepted by Mr. R. G. Oakley on decaying palms and



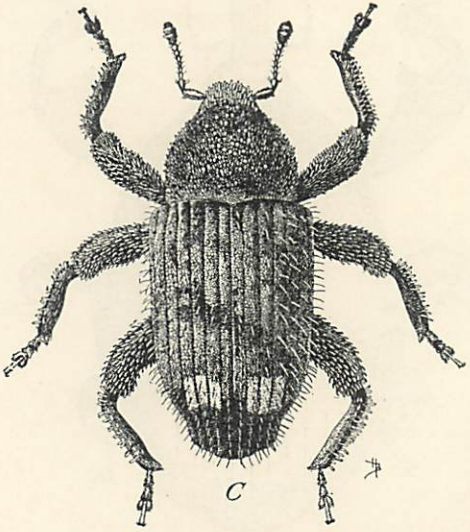
The Cucubano Seed Weevil, *Pseudomopsis cucubano* sp. nov., fifteen times natural size. (Drawn by G. N. Wolcott, original.)

on dead wood in the mountains back of Ponce, at Indiera, Guayanilla, Adjuntas and Villalba. These are comparatively large weevils, 7 to 8 mm. long, black and deeply punctured, with conspicuous whitish areas posteriorly on the elytra, and smaller ones elsewhere.

Euscepes porcella, described by Carl H. Boheman in Schönherr's "Genera et Sp. Curculionidum" (4 (1): 430. Paris, 1844), the type from Puerto Rico, has an extensive distribution in the West Indies, Central America, Mexico and southern Florida, where it is found "common beneath decaying stems of the water hyacinth next to the water's edge". It has been little collected in Puerto Rico except by birds, Dr. Alex. Wetmore having found it in the stomach contents of the cliff swallow, vireo, redstart,

ovenbird, three warblers, the honey creeper, yellow-shouldered blackbird, oriole, mozambique and grasshopper sparrow. According to Blatchley & Leng (1916–189), it is "brown, densely clothed with dark brown and clay-yellow scales, the latter covering the basal and apical thirds of elytra".

Euscepes postfasciata Fairmaire, much better known under the name of *batatae* Waterhouse, under which it was re-described a year later, is the "scarabee" of sweet potatoes in the British Islands. It is by far the most serious pest of sweet potatoes in Barbados, and in some of the other Lesser Antilles, but in Puerto Rico is of minor importance by comparison with the "piche" (*Cylas formicarius*). First recorded from Puerto Rico by Van



The "Scarabee," *Euscepes postfasciata* Fairmaire, fourteen times natural size. (Drawn by Harry Bradford.)

Zwaluwenburg in his list (926) at Mayagüez on sweet potatoes and pomelo rind, it has most often since been noted in the Mayagüez region, with individual records from Arecibo, Río Piedras and Guayanilla. Mrs. Raquel Dexter found it eaten by the Surinam toad, but Dr. Wetmore found it eaten by no bird, and apparently it is too rare to be eaten by them or by lizards. It is readily distinguished from *Euscepes porcella* by the light colored scales being limited to a rectangular area of three intervals on the posterior third of the elytra.

In studying the "Birds of the Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1931), Dr. Stuart T. Danforth includes in the grass association a leguminous herbaceous

shrub: "sesbania" (*Sesban emerus*), which is attacked by a weevil, **Tyloderma** sp. Despite its importance in his studies, for these weevils form a more or less appreciable factor in the food of sandpipers, the killdeer, ani, kingbird, yellow-shouldered blackbird, waterthrush and parula warbler, it has never been more exactly identified, the indefatigable Mr. Oakley never intercepted it in recent years, and Dr. Wetmore does not report it as forming an item of food for the birds that he collected.

As this weevil appears to be still unnamed and undescribed, I am calling it **danforthi,** describing it from material loaned by Prof. J. A. Ramos, collected January 1935 at Cartagena Lagoon by Mr. V. Biaggi. Of uniform size, 5.0 mm. long and 2.2 mm. wide, it is larger than any species of *Tyloderma* from the eastern United States except *foveolata* Say, which varies in size from 3 to 5.8 mm., and is otherwise quite distinct, listed by Mr. W. S. Blatchley and Dr. C. W. Leng (1916–491) from Florida, "in stems of the evening primrose." All mature specimens are dark reddish-brown, highly polished above, below dull; thorax impunctate but with scattered silvery hairs, plump pear-shaped, much longer than wide, rounded in front, widest a third of the distance from the base, concavely constricted above forelegs and behind eyes, slightly so even on vertex; elytra becoming parallel and straight at sides before base, sparsely and unevenly pubescent, evenly and deeply punctate, appearing furrowed on disc and towards apex.

Gasterocercus richteri Fischer, the type from Puerto Rico (1888–154), has not since been found.

Coelosternus armipes Boheman, known also from St. Vincent and Guadeloupe, is "A Little-Known Root-Weevil of Cassava (*Coelosternus sulcatulus* Boheman)" (Jour. Dept. Agr. P. R., **14** (3): 159–163, fig. 1, pl. 3. San Juan, August 1930) which Dr. M. D. Leonard found at Comerío and on which he made life-history studies. More recently it has been found at Río Piedras, but in such small numbers that economically it is of negligible importance.

Numerous collections have been made of weevils belonging to the genus **Cryptorrhynchus** of which individuals vary so much in size and markings that no specific names have been assigned to them. One species is reasonably common on bark of coffee shade trees in the mountains, and possibly represents a single species.

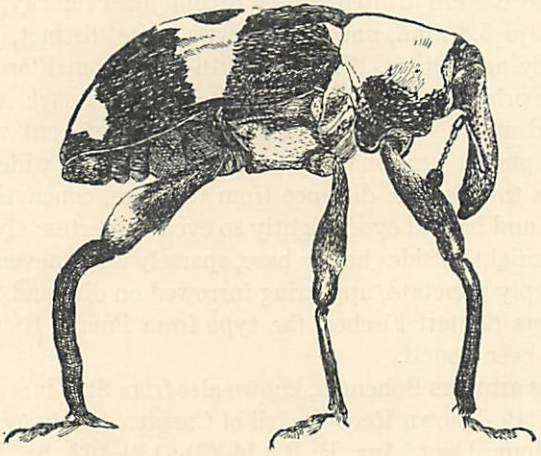
Lechriops psidii, described by Sir Guy A. K. Marshall (1922–69), the type from Puerto Rico, 2.0 mm. long, 0.9 mm. wide, is reddish-brown, densely covered with white, buff or yellowish brown scales. Reared from mummied guava fruit, it is one reason why *Psidium guajava* yields so little marketable fruit in Puerto Rico, for this little weevil occurs everywhere in the Island that guava bushes grow.

A weevil intercepted by Mr. R. G. Oakley in dead bark at Guánica was

determined by Mr. L. L. Buchanan as a species of **Copturus,** and one on "guácima" (*Guazuma ulmifolia*) at Boquerón as a species of **Tachygonus.**

Hypurus near **bertrandi** Perris is the redetermination by Mr. L. L. Buchanan of weevils reared by Mr. Thos. J. Jones from larvae mining in the leaves of portulaca, which Dr. E. A. Schwarz had originally identified as a new species of *Hypocoeliodes*. Mr. R. G. Oakley recently intercepted adults in the seed pods of a weed at Ponce.

Auleutes inspersus Champion was the determination by Sir Guy A. K. Marshall of weevils which Dr. Stuart T. Danforth found on *Jussiaea* at Mayagüez in October 1932, and had earlier found at Cartagena Lagoon,



Peridinetus signatus Rosenschoeld, six times natural size.
(Drawn by G. N. Wolcott.)

Caguas and at Las Marías. Numerous other beetles of this genus and possibly this species have been intercepted on a variety of other hosts.

"Allied to *Auleutes* and more closely so to *Hypocoeliodes*, but differing from both by the huge eyes, the more slender, subcylindrical, feebly-sculptured rostrum which rises abruptly from the head" is *Panophthalmus* "A New Genus and four new species of West Indian Curculionidae" (Mem. Soc. Cubana Hist. Natural, **10** (3): 145–152. Habana, 1936) erected by Mr. L. L. Buchanan to include **Panophthalmus puertoricanus,** of which the type was intercepted by Mr. R. G. Oakley, at Juana Díaz. It is 2.3 mm. long, 1.68 mm. wide, its dark "body clothed with minute, fuscous and golden subrecumbent hairs and setae and white scales; pronotum with large, medio-basal patch of scales; elytra with a transversely rectangular patch of scales and other scattered spots".

Peridinetus concentricus Olivier (1844–207), *Peridinetus maculatus* Rosenschoeld (1837–471) and **Peridinetus signatus** Rosenschoeld (1837–472) are names all of which presumably refer to the same distinctively marked beetle, which makes round holes in the leaves of "higuillo" (*Piper* spp.) and of which the larvae bore in the stems of the same host plants. It occurs in all the more humid regions of the Island where the host plants grow, as well as in Hispaniola and Cuba. In tropical South America, the same or similar hosts are to be noted with identical round holes in their leaves, eaten by adults varying only in degree of yellowish shading from the more sharply marked species of the West Indies. Chevrolat gives Olivier's name, but Dr. Gundlach lists this in synonymy with *signatus*; and *maculatus* separately. If *maculatus* is a distinct species in Puerto Rico, no specimen has been identified from here since the type collection. Dr. Stahl lists only *signatus*, and this is in Van Zwaluwenburg's list (P. R. 36): on *Piper peltatum*. Despite the comparative abundance of the beetles, there are no records of their being eaten by birds, lizards or the toad, but their escape may be due to their retiring habits, certainly not because of their conspicuous coloration.

Baris torquata Olivier, described as a *Rhynchaenus*, the type from Puerto Rico (1807–145), is a somewhat smaller but even more conspicuous weevil of shining black with extensive areas of dense white scales. Listed by Chevrolat and Drs. Gundlach and Stahl, it was noted by Dr. Wetmore as eaten by the cliff swallow and the mozambique, and it has since been found eaten by the crested lizard, *Anolis cristatellus*. Dr. Richard T. Cotton calls it (1918–300) the "Eggplant Stem Borer: a pest of both wild and cultivated eggplant. The adult feeds on foliage, the female lays small, white, oval eggs in a crescentric slit in the stem; the larva bores in stem and branches". It occurs only in Puerto Rico, but has been noted on its specific hosts in all parts of the Island.

Geraeus montanus sp. nov. Rhomboidal, convex. Black, with oval areas of dense white scales near base of elytra covering intervals 2 to 7; smaller, narrower transverse area two-thirds towards apex on intervals 3, 4 and 5; most conspicuously scaled also on apical half of episternum; prosternum, lateral margins of 3d and 4th abdominal segments and legs grey with less dense whitish scaling. Beak, large, stout, black, one-third length of body, curving at angle of 45° at middle; head impunctate, shining; eyes, large, dull black, not contiguous. Thorax closely and finely punctate, one-third wider than long. Elytra oval, with humeral angles distant from base, elytron three times as long as wide, deeply striate and closely punctate, intervals convex. Length, 2.7 mm.; width 1.2 mm.

Described from numerous adults on flowers of "botoncillo" (*Borreria verticillata*) at Barros (Matrullas Dam), October 10, 1939, which Mr. L.

L. Buchanan placed in the genus *Geraeus* and stated to be the same as others intercepted by Mr. R. G. Oakley at Villalba previously identified as a species of *Centrinus*. On May 1, 1940, Dr. Donald De Leon and Dr. Luis F. Martorell found additional specimens (and other weevils) on the flowers of 'inmortal" (*Helichrysum bracteatum*) at Doña Juana Camp, Villalba, but these and those collected by Mr. Oakley at Villalba were not seen in preparing this description.

Diorymerellus politus Chevrolat (1880–307), with priority over *D. obliteratus* Champion (1908–252), the identification by Sir Guy A. K. Marshall of the first specimens sent from Puerto Rico, is an entirely black and very shiny weevil first found in the flower bracts of orchids on El Yunque and subsequently becoming a pest of vanilla of sufficient importance to merit notice in the Mayagüez Station Report for 1938 (p. 119).

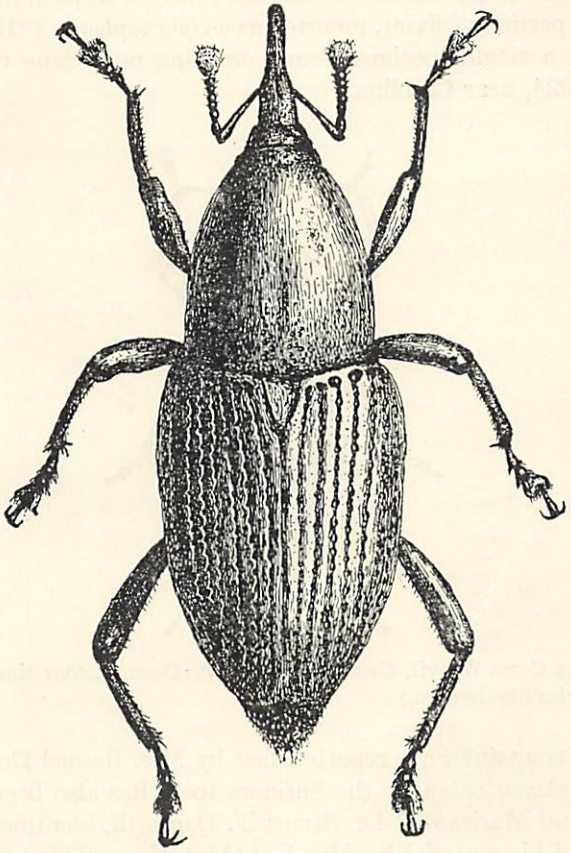
Anacentrinus sp. was the determination by Mr. L. L. Buchanan of weevils taken from the flowers of wild parsnip at Cayey in 1939.

Zygobaris sp. was the determination by Mr. L. L. Buchanan of weevils intercepted by Mr. R. G. Oakley on *Matayba*; those on pomarrosa at Ponce and on flowers of *Senegalia* at Ponce, represent two distinct species of **Catapastus.**

Ampeloglypter cissi was the name given by Sir Guy A. K. Marshall (1922–70) to some little Puerto Rican weevils with the "color uniform dark steel-blue above, the head, rostrum and lower surface blue black; length 2.0 mm.", found feeding on tender shoots of wild grape (*Cissus sicyoides*) at Río Piedras, July 5, 1921. A few individuals have been noted at Río Piedras in succeeding years, but never in such abundance as at the time of the type collection.

Metamasius hemipterus Linnaeus was first recorded from Puerto Rico under the name *Sphenophorus sericeus* Latreille by Dr. Stahl, by Dr. Gundlach with the note "en los troncos muertos de plátano (*Musa*)", and by Mr. Aug. Busck (1908–89) as *Sphenophorus sexguttatus* Drury, injuring sugar-cane. In Van Zwaluwenburg's list (305) it is given as a pest in sugar-cane, coconut palm and *Lantana* sp. The rotten stalk borer of sugar-cane, or "el gorgojo de la caña podrida", is noted by Mr. D. L. Van Dine in all his accounts of the insects of sugar-cane as not a serious pest. Mr. E. G. Smyth (1919–142) in addition records it in "dead or injured palm trunks; in banana trunks, more rarely, with the adults sometimes attacking the fruit". It is a comparatively common insect, often coming to rest in an automobile, or noted in flight. Adults often alight on the sunny gallery of the agronomy building of the Experiment Station at Río Piedras. Dr. Wetmore found that the adults formed over 5% of the stomach contents of the mozambique and the kingbird, and smaller fractions of the food of the petchary, ani, oriole and yellow-shouldered blackbird, and Mrs. Raquel

Dexter that they are eaten by the Surinam toad. The Green Muscardine fungus, *Metarrihizium anisopliae*, also attacks the adults, as noted by Mr. J. A. Stevenson (1918–22), but is a comparatively minor factor in control. Field rats are of decisive importance in determining the abundance of this weevil, for the female normally lays her eggs in injured cane stalks that have been eaten by rats, and but rarely in such a minor injury as the

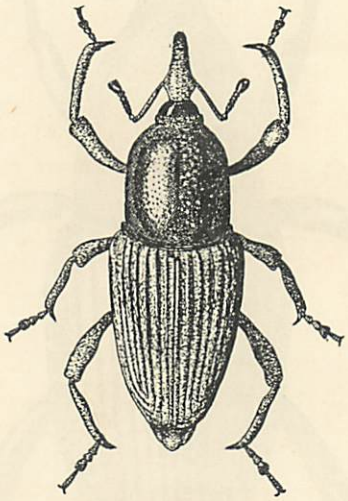


The Rotten Stalk Borer of Sugar-Cane, *Metamasius hemipterus* Linnaeus, eight times natural size. (Drawn by Francisco Seín.)

emergence tunnel of *Diatraea saccharalis*. As soon as the larvae have begun their development, the rotting cane stalk acquires a distinctive odor of acetic acid which becomes ever more pronounced as more of the stalk is infested. The larvae feed on the pith of cane, and when fully grown, wind about their bodies the long uneaten fibers to form a most characteristic pupal covering. All stages of development are often to be found present

in a single stalk, the lightly colored adults, half an inch long remaining within their pupal wrappings until they become fully darkened: black streaked with dark chestnut. Exceptionally, larvae may occur also in the stems of live banana plants, and adults feed on many kinds of decaying juicy vegetation, such as rotten fruits of mamey, papaya, mango, maga, guava and pineapple. The insect occurs in all parts of Puerto Rico, as well as in most of the Lesser Antilles and much of tropical South America.

Calendra pertinax Olivier, reported as a *Sphenophorus* ("IB" 1936–316), is based on a single specimen found crawling on a cane railroad track, March 1, 1924, near Carolina.

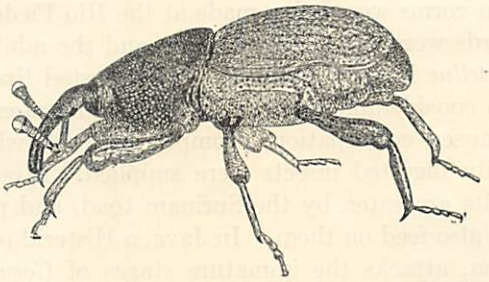


The Banana Corm Weevil, *Cosmopolites sordida* Germar, four times natural size. (Drawn by Fritz Maximilien.)

Calendra venustus Say, reported first by Mrs. Raquel Dexter (1932–5) as a *Sphenophorus* eaten by the Surinam toad, has also been collected at Mayagüez and Maricao by Dr. Stuart T. Danforth, identifications having been made of his material by Mr. A. J. Mutchler. This corn bill-bug or "elephant bug" has also been found in Cuba, and in the States "ranges from Maine to Wisconsin, south to Florida and Texas, common along the seashore of New Jersey" and often "taken beneath seaweed on the Gulf beach".

Cosmopolites sordida Germar, the banana corm weevil, was first noted in Bo. Malvilla, Vega Alta, in December 1921, but by early in 1922, it was found at Corozal, and in Bo. Cupey and at the Experiment Station at Río Piedras. Adults were identified by Sir Guy A. K. Marshall, who warned of the potential danger and recommended eradication if that were

still possible. The habits of adult and larva attacking the corm of live banana plants was ample indication of the advent of a new and serious pest, first known from the East Indies, and brought by man in infested corms to many of the countries of tropical America and Guadeloupe and Dominica of the Lesser Antilles. To date, this pest of bananas and plantains does not occur in Hispaniola, Cuba and Jamaica, naturally making the cost of production less in these islands than it is in Puerto Rico. Within the next few years after its first discovery at Vega Alta, it had spread to all the banana growing regions of the Island, Dr. Stuart T. Danforth having an abundance of specimens before 1930 from Mayagüez, Cabo Rojo, Yauco and generally in the mountainous areas of central and western Puerto Rico. Superficially, the legless grubs are indistinguishable from those of *Metamasius hemipterus*, which may at times occur in the still living portions of



The Banana Corm Weevil, *Cosmopolites sordida* Germar, four times natural size. (Drawn by Francisco Seín.)

the stalks of bananas, but normally lives only in decaying or rotting tissue, while the grubs of *Cosmopolites* are in living corms. The entirely black adults are readily attracted to slices of corms placed in infested groves, as are also to some extent the adults of the striped *Metamasius*, and by persistent collecting from freshly cut corms one may greatly reduce infestation. It is impossible, however, by such means to entirely eliminate infestation, and even the exceptional grower can not be induced to maintain collections when few adults are taken from his traps. Mr. Francisco Seín, experimenting with "Paring and Heat Sterilization of the Corms to Eliminate the Banana Root Weevil" (Jour. Agr. Univ. P. R., **18** (3): 411–16, pl. 1, fig. 2, ref. 2. Río Piedras, October 27, 1934), proved that placing the corms near a fire or submerging them in boiling water for a few minutes will not kill either eggs or larvae, but paring the corms eliminates the eggs and indicates the presence of the grubs in their tunnels. Such pared corms are very susceptible to reinfestation, and must be planted the same day in land not previously infested. Corms for planting may be freed from all stages of the weevil, without the bother and uncertainty of paring, and

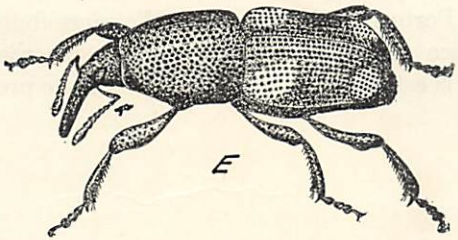
with no damage to the corm, by heat sterilization at 43°C. for EIGHT hours in a circulating atmosphere saturated with moisture. Such a sterilizer is somewhat expensive to construct, and can be used to advantage only by large growers, but its use avoids all danger of careless inspection, or not paring deep enough to eliminate all the weevils. Circular No. 103: "Para Combatir el Gorgojo del Plátano—Método de Mondar la Semilla" (Est. Expt. Agricola, pp. 5–11, pl. 1, fig. 2. Río Piedras, November 24, 1934) proved so popular that the entire edition of 2,000 copies was distributed in less than three weeks, and this method of control has proved so effective in practise that the growing of bananas and plantains is still possible everywhere in Puerto Rico that farmers have adopted these recommendations.

The accidental introduction of *Cosmopolites sordida* occurred after the investigations on the food of birds and of lizards had been completed. Collections from corms were being made at the Río Piedras Station, however, when lizards were being reared there, and the adults were supplied to *Anolis cristatellus* in large numbers. The crested lizards ate the hard black weevils in considerable numbers, at first, but a steady and exclusive diet of them caused constipation, promptly relieved when other, softer and more readily digested insects were supplied. Mrs. Raquel Dexter found that adults are eaten by the Surinam toad, and presumably some terrestrial birds also feed on them. In Java, a Histerid predator, *Plaesius javanus* Erichson, attacks the immature stages of *Cosmopolites* in their tunnels in the corms, and, as related in the Mayagüez Station Report for 1938 (p. 101), adults of this beetle were imported from Fiji. In captivity in Puerto Rico, the adult Histerids fed on both larvae and pupae of *Cosmopolites*, but no trace has since been found of those released in a banana grove at Adjuntas. Indeed, when search was being made for these introduced beetles, a native earwig, the variety *gagathina* Burmeister of *Carcinophora americana* (P. de B.), was found in the tunnels, and in captivity fed on the larvae of the weevil. The practical banana or plantain grower can not depend upon any of these factors in natural control, or all of them combined, but must use the methods devised by Mr. Seín if he is to continue producing a commercially profitable crop.

Sitophilus linearis Herbst, originally described from St. Barthélemy, was first reported from Puerto Rico by Dr. Gundlach, that it "come las semillas del tamarindo". So far as known, the seeds of the tamarind (*Tamarindus indica*) are the only host, and the weevils infest the seeds in most of the countries where this tree has been introduced. They occur in all parts of Puerto Rico, sometimes in such abundance as to form an item in the food of the crested lizard, *Anolis cristatellus*.

Sitophilus oryzae Linnaeus is a cosmopolitan pest of rice, noted in Puerto

Rico by Drs. Stahl and Gundlach, the latter adding "muy dañina por la destrucción de los granos del maíz". Besides causing enormous damage to its normal hosts of corn and rice, it has been found in a seed of "mamey" (*Mammea americana*) at Isabela, resting under dead bark of "bucare" (*Erythryna poeppigiana*) at Cayey, and intercepted at San Juan in dry chick peas, in ñame root and on tomato fruit, and at Carolina and Utuado in dry herbs. In international commerce, this weevil is imported and exported as an adult and in immature stages in its hosts, the record from Mona Island presumably due to the food supplies brought to that Island. Mr. O. W. Barrett (1905–396) at Mayagüez noted parasitism by *Pteromalus calandrae* Howard, and Dr. Wetmore reported finding this distinctively four-spotted weevil eaten by Latimer's vireo, both of which are insignificant factors in natural control. Mr. H. K. Plank, trying to find cheap, practical and simple methods for "The Control of Storage Insects in Corn Seed" (Jour. Ec., **39** (3): 314–19, fig. 1, ref. 8. Menasha, June 1946) notes that



The Rice Weevil, *Sitophilus oryzae* Linnaeus, ten times natural size. (After Cotton.)

"rolling the partly dry seed ears in hydrated lime gave the most satisfactory results" in maintaining viability and preventing attack by the rice weevil. In three or four days after harvest, the corn grains have dried sufficiently so that the lime, one part to forty parts of grain by weight, may be applied, the protection against attack thus afforded being better than when other dusts with known fungicidal properties are used, or the grain is fumigated with carbon bisulfide.

Nanus uniformis Boheman (in Schönherr), which Dr. Gundlach noted "se encuentra frecuentemente en la parte interior de una llagua de Palma real fresca", has subsequently been intercepted by Mr. R. G. Oakley in the pollen of a royal palm at Ponce.

The weevils intercepted by Mr. R. G. Oakley in rotten wood at Aibonito were identified by Mr. L. L. Buchanan as a species of **Micromimus.**

Cossonus canaliculatus Fabricius, first recorded by Leng & Mutchler from Puerto Rico, is a small black weevil which has recently been found under bark and chips of wood of "almácigo" (*Bursera simaruba*) at Salinas.

It occurs also in Trinidad, northern South America, Central America and Mexico, and of it *Cossonus vulneratus* Illiger is a synonym.

Cossonus impressus Boheman is the determination by Mr. A. J. Muchler of weevils collected on Mona Island for the American Museum of Natural History and listed in a "Supplement to Preliminary List of the Coleoptera of the West Indies" (Bull. Amer. Mus. Nat. Hist., **37** (5): 191–220. New York, February 13, 1917) by Dr. Charles W. Leng and Mr. Mutchler. Specimens collected by Dr. Stuart T. Danforth at Aibonito were thus identified by Mr. Mutchler, and Mr. L. L. Buchanan gave this determination to material intercepted in rotten wood by Mr. R. G. Oakley at Ponce and Aibonito.

Caulophilus latinasus Say was first reported from Puerto Rico by Dr. F. H. Chittenden as the "Broad-Nosed Grain Weevil" (Bur. Ent. Bull. ⁄96, pt. 2, pp. 19–24. Washington, D. C., March 31, 1911) when on "February 3, 1899, living beetles were found in equal numbers with the rice weevil in shelled corn and chick-peas (garbanzos) purchased in a store by Mr. August Busck at Arroyo, Porto Rico". Dr. Alex. Wetmore found it eaten by the honey creeper, since which time it has not been recorded here. Indeed, it is doubtful if it is established in Puerto Rico at the present time.

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THE INSECTS OF PUERTO RICO

By *George N. Wolcott*

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THE INSECTS OF PUERTO RICO

COLEOPTERA

By GEORGE N. WOLCOTT

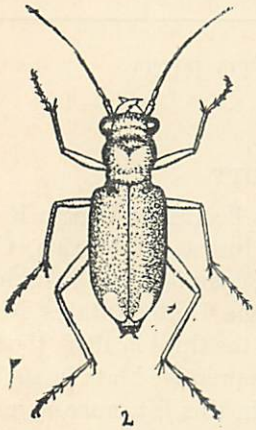
The very latest authoritative names for the beetles of Puerto Rico are included in the "Checklist of Coleopterous Insects of Mexico, Central America, the West Indies and South America", compiled by Dr. Richard E. Blackwelder. This is Bulletin No. 185 of the United States National Museum, of which two parts appeared in 1944, the third in 1945, the fourth in 1946, while the fifth and concluding part was received late in 1947. As indications of generic transfers are not given in this list, none is included in the following pages. His changes in the gender of specific names are followed in the first citation even of economic insects, but often not subsequently.

Cicindelidae: Tiger Beetles

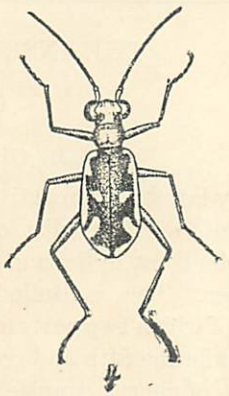
The "Descriptive Catalog of the West Indian Cicindelinae" (Bulletin Amer. Mus. Nat. Hist., **35** (36): 681–699, pl. 1, fig. 5. New York, October 17, 1916) by Dr. C. W. Leng and Mr. A. J. Mutchler, gives illustrations of the four species found in Puerto Rico, and of the alkali flat at Guánica where some of them were collected by the writers.

Megacephala sobrina Dejean, var. **infuscata** Mannerheim, called by Drs. Stahl and Gundlach *Tetracha infuscata* Chaudoir, is mostly an iridescent purplish green beetle, the apex of its elytra a semi-transparent yellowish brown. Its prominent mouth-parts, slender antennae and legs are opaque yellowish-brown. Mr. W. V. Tower (First Rpt. Bd. Comm. Agr. P. R., p. 20. San Juan, Jan. 1, 1912) states that it is predaceous on the changa, but we really know very little about what insects it normally feeds upon, as it is not often seen, and relatively few collections of it have been made. It is active only at night, but is neither attracted nor repelled by light. According to Leng & Mutchler it hides during the daytime under dung and debris around the higher part of the alkali flat at Guánica. It is not confined to such an environment, however, for it has been collected in all parts of the Island, in the mountains and along the coast, and in cultivated fields. Despite the speed with which this beetle runs, it is caught and eaten by the introduced toad, *Bufo marinus* (L.), as was first reported by Mrs. Raquel Dexter (1932–5), and its remains have since been found in toad excrement, the elytra being unmistakable. It is possibly for this reason that the beetle has been no more abundant in recent years.

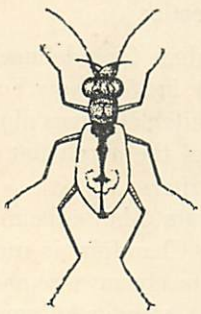
Cicindela boops Dejean has iridescent dark green legs, but is mostly lighter green, coppery, the lateral margins of the elytra whitish. In Puerto Rico it occurs only around alkali flats and near the salt ponds of the south-



Megacephala sobrina Dejean var. *infuscata* Mannerheim. (After Leng & Mutchler.)



Cicindela boops Dejean. (After Leng & Mutchler.)



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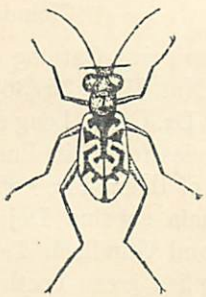
Cicindela suturalis F. (After Leng & Mutchler.)



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Cicindela suturalis var. *hebraea* Klug. (After Leng & Mutchler.)

western corner of the Island: at Faro de Cabo Rojo, Parguera, Guánica and Ensenada.

Cicindela suturalis F., with elytra mostly whitish, is reported from Puerto Rico by Leng & Mutchler, but all collections at definite localities are of the variety **hebraea** Klug, which has more of the elytra green. Drs. Stahl and Gundlach noted the latter, and recent collections have been made at Añasco, Aguadilla and Camuy.

The elytra of **Cicindela trifasciata** F. are mostly dull, dark green, with a narrow pattern in white. This is the common species, reported by Drs. Gundlach and Stahl under the name *C. tortuosa* Dejean, often found in great abundance on the beaches all around the Island, but especially on the north coast, as at the ferry landing at Loíza Aldea and on Pt. Picua, Mameyes. It also occurs on the sandy banks of fresh water streams, and even in sandy cane fields, as well as on the margins of the salt lagoons of the south coast. One can but wonder what all these beetles and their larvae find to feed upon, for at times they are so much more numerous than any other insect or other small animal present on these sandy beaches. The larvae, like the adults, are entirely predaceous, and depend for their food on whatever happens to fall into their open burrows in the soil.

Carbidae: Ground Beetles

Calosoma alternans F. is the only large predaceous ground beetle that occurs in Puerto Rico. It averages an inch in total length, and in color is a dark greenish bronze, with three rows of iridescent pinkish punctures on each deeply striate elytron. Noted by the earlier entomologists under the name given by Fabricius that has persisted unchanged since 1791, it was later recorded by Mr. R. H. Van Zwaluwenburg as attacking the caterpillars of the cane looper (*Mocis repanda*) and white grubs, while Mr. Thos. H. Jones thought it probably predaceous on the southern grassworm (*Laphygma frugiperda*). The adults, being nocturnal in habits, seem not very common, but Dr. Wetmore found that they had been eaten by the ani, and Mrs. Dexter by the introduced toad. Collections have been made in all parts of the Island, usually on pavements in towns, feeding on the insects attracted to lights, but sometimes the beetle is disturbed when a field is being plowed, and runs distractedly about in search of shelter.

Scarites montana (= *S. mutchleri* Bänninger), described by Mr. A. J. Mutchler (Amer. Mus. Novitates No. 686, pp. 5. New York, January 6, 1934), the type from El Yunque, is a comparatively large (17.0 mm. long), black, elongate beetle which he thought might be the "*Scarites subterraneus* Fabricius recorded by Stahl".

At an elevation of 3,000 feet in the Maricao Forest was collected the type of **Scarites danforthi,** one of the many new species of Carabid beetles which Dr. P. J. Darlington, Jr. found in Puerto Rico, of which descriptions were published in a series of articles beginning in 1934–5 in "Psyche" and concluded in the April 1939 number of Mem. Soc. Cubana de Historia Natural. Most of the recent collections of Carabids in Puerto Rico were made or inspired by Dr. Darlington, who was always ready to identify or describe the new species collected by others.

As **Oxydrepanus coamensis,** Dr. Darlington notes the collection on El

Yunque of what Mr. Mutchler (1934–2) described as a *Dyschirius*, "length 2.0 mm., shining, reddish, prothorax globose".

The elongate, yellowish-brown **Clivina limbipennis** DuVal has been collected at Mayagüez and Cabo Rojo, and the black **Clivina addita** Darlington at Mayagüez. The small reddish-brown **Clivina insularis** DuVal has been found at many localities, at Tortuguero, Cartagena and Guánica Lagoons, and Mr. E. G. Smyth, making collections under cow dung at Guánica, thought it might be predaceous on horn-fly eggs and larvae.

The minute coppery iridescent **Ardistomus mannerheimi** Putzeys and the black **Aspidoglossa aerata** Putzeys have been collected only at Mayagüez, but the larger, shining black and reddish-brown **Aspidoglossa vulnerata** Putzeys, reported by Drs. Stahl and Gundlach under the name *A. bipustulata* F., is presumably more common, and has been collected elsewhere on the Island.

The type of the "slightly convex, piceous, shining, length 3.5 mm." **Bembidion darlingtoni** Mutchler (1934–3) was from Ensenada, and Dr. Danforth collected many specimens at the Cartagena Lagoon, but it has also been found at Ponce, Coamo and Caguas. The type of the shining **Bembidion portoricense** Darlington is from El Yunque. **Bembidion fastidiosum** LaFerte and the dull black **Bembidion sparsum** Bates are apparently mountainous species, but **Bembidion viridicole** LaFerte (= *B. chevrolati* C. & H.) was collected at Ensenada by Prof. J. A. Ramos. Dr. Wetmore found that the semipalmated sandpiper had eaten some one of these species of *Bembidion*. The "oblong, parallel, testaceous, in great part dark brown, length 2.25 mm." **Tachys ensenadae** described by Mr. A. J. Mutchler (1934–3) from a type at Ensenada and others at Arecibo, was found in abundance by Dr. M. D. Leonard on Vieques Island, and Prof. J. A. Ramos has specimens from Mona Island. Dr. Gundlach reports **Tachys macrodentra** Chevrolat and **Tachys vittiger** LeConte, and more recent collections have been made of **Tachys blandula** Schaum, **Tachys corrusca** LeConte, **Tachys carib** Darlington, **Tachys piceola** LaFerte and the light-colored **Tachys vorax** LeConte.

The holotype of **Micratopus insularis** Darlington (1934–86) is from San Juan, but it has since been taken at Humacao. It has a very small head and is less than 2.0 mm. in total length.

The little, light yellow **Perileptus dentifer** Darlington (1935–177) lives in the gravel of the river at Mayagüez, and Mr. R. G. Oakley intercepted it at Ponce.

Panagaeus quadrisignatus Chevrolat is the presently accepted name for what was recorded by Dr. Gundlach as *Panagaeus fasciatus* Say, a rather common and certainly a very distinctive black beetle with two irregular

chestnut spots on each deeply furrowed elytron, found in all parts of the Island. It is three-eights of an inch long and almost half as broad.

Morion georgiae Palisot de Beauvois, listed by Drs. Stahl and Gundlach as *Morio monilicornis* Latreille, was reported from Vieques Island by Leng & Mutchler.

Loxandrus celeris Dejean was collected at Guánica Lagoon by Prof. J. A. Ramos.

On Mona Island, Prof. J. A. Ramos found numerous specimens, identified as a species of **Tetragonoderus** by Mr. J. M. Valentine, none of this genus being known from Puerto Rico.

Colpodes estriata was described by Dr. P. J. Darlington (1939–96) from specimens taken on El Yunque.

Lachnophorus leucopterus Chevrolat, with small head and thorax, grey elytra with three deep punctures on each, has been collected at Mayagüez, and in river gravel at Maricao.

In 1899 at Bayamón, Mr. August Busck collected the type, and another at Fajardo, from which Dr. P. J. Darlington (1934–99) described **Perigona microps,** since found also on dead wood at Villalba.

Chlaenius perplexus Dejean, a large dull brown beetle, has been collected at Mayagüez, Arecibo and Luquillo.

(Dr. Stahl lists *Oodes femoralis* Chaudoir.)

Stenocrepis metallica Dejean has been collected at the Cartagena Lagoon and at Ponce. The much more common **Stenocrepis tibialis** Chevrolat, listed by Drs. Stahl and Gundlach as a *Stenous*, dark green and bronze in color, is also from the southwestern corner of the Island. Dr. Stuart T. Danforth, in his study of the food habits of the birds of Cartagena Lagoon, found that this beetle was eaten by three kinds of sandpipers, the killdeer, the lesser yellow-legs and the northern water thrush.

Gynandropus guadeloupensis Fletiaux & Sallé, a dark iridescent greenish-black Carabid, has been collected at Humacao and Mayagüez.

Twelve species of *Selenophorus* are known to occur in Puerto Rico, of which the types or paratypes of four were collected on the Island. **Selenophorus alternans** Dejean, with the elytra deeply punctate and only faintly striate, is a very common species, noted by Dr. Gundlach, and since collected in all parts of the Island, usually at light. It has also been found on Mona Island by Prof. J. A. Ramos, "under stones near the cliff" and under dead leaves. **Selenophorus beauvoisi** Dejean has been collected at Ensenada. **Selenophorus chalybaeus** Dejean, a large black species with deeply striate elytra, the largest of the genus in Puerto Rico, has been taken at Guánica and at Coamo. Dr. Gundlach collected **Selenophorus discopunctatus** Dejean, and it has since been found under lights

on Vieques Island and at Aibonito and at Bayamón. Concerning **Selenophorus flavilabris** Dejean, nothing more definite than Puerto Rico is known as to place of collection. Dr. P. J. Darlington described **Selenophorus latior** (1934–109) from the type collected (GNW) at Haina, Dominican Republic, with paratype collected (GNW) from one square foot of pasture at Pt. Cangrejos, Puerto Rico. It occurs in dead seaweed on the beach there, and has subsequently been found on the ground at Jayuya. **Selenophorus puertoricensis** was described by Mr. A. J. Mutchler (1934–5) as "aeneous, greenish to coppery on pronotum, coppery on the elytra, length 10.0 mm." from Desengaño, others from Mt. Mandios. Drs. Stahl and Gundlach list **Selenophorus pyritosus** Dejean. The little shining black **Selenophorus sinuatus** Gyllenhal has been found at Jayuya, Caguas and Cayey, the peons calling it "cucaracha" and claiming that it attacks tobacco leaves. Prof. J. A. Ramos found it at Cartagena Lagoon, and "under stones near the cliff at Sardinera Beach" on Mona Island. The holotype of **Selenophorus parvus** Darlington (1934–105) is from Coamo Springs, and "resembles a small *S. sinuatus*". The type of **Selenophorus ramosi** Darlington (1939–97) was from Guánica Lagoon, and it has also been collected at light in the Guánica region. **Selenophorus striatopunctatus** Putzeys has been found in the mountains and along the coast of western Puerto Rico.

The paratypes of **Bradycellus (Stenocellus) velatus** Darlington (1934–111) were collected at Río Piedras.

Acupalpus ochropezus Say, also listed as a *Stenolophus*, has been collected in all parts of the Island.

The type of **Masoreus (Aephnidius) ciliatus** Mutchler (*in* Darlington 1934–130) was collected on a cactus-covered hill at Ensenada.

The bright iridescent blue-green of **Lebia viridis** Say (which Dr. Darlington re-identifies as *Lebia marginicollis* Dejean) is very conspicuous among the dark or dull-colored Carabids. The duller **Lebia bitaeniata** Chevrolat has two yellow bands across dull blue elytra. Both species have been collected mostly at Río Piedras, Dr. R. T. Cotton noting of the former, found on cucumber vines, that "it was probably feeding on aphids".

The type of **Phloeoxema portoricensis** Darlington (1939–99) is from El Yunque, and others have been collected in the Maricao Forest. It has striate, dull blue-black elytra, and is mostly yellowish elsewhere.

The margins of the elytra of the dull brown **Apenes marginalis** Dejean are yellow, a large and rather common Carabid, found in all parts of the Island. M. Chevrolat himself identified Dr. Gundlach's specimens, placing them in the genus *Cymindis*.

The dull reddish brown **Apenes parallela** Dejean, listed by Dr. Gundlach under the name *Cymindis variegata* DeJean, has since been collected by

Dr. Danforth at Coamo. The dull **Apenes pallipes** F. has been collected by Prof. J. A. Ramos at Mayagüez, Ensenada and Guánica Lagoon. **Apenes portoricensis** was described by Dr. P. J. Darlington (1939–100) from types collected at Guánica Lagoon.

Dr. P. J. Darlington described (1934–121) **Pentagonica divisa**, an exclusively endemic Carabid previously reported by Dr. Gundlach as *Rhomobodera atrorufa* Reiche, and more recently, because of yellow head and thorax and dark elytra, listed as *Pentagonica bicolor* LeConte. **Pentagonica flavipes** LeConte, which is entirely brown in color, and its variety **picipes** Darlington (1935–212) the type from Jamaica, but also in Puerto Rico, has been collected at Mayagüez and Luquillo.

Colliuris (Odacanthella) portoricensis Leibke (Mitt. Zool. Mus. Berlin, **15:** 658. 1930) was described from Puerto Rico. Both Dr. Stahl and Dr. Gundlach list as *Casnonia insignis* Chaudoir the local variety of **Colliuris rufipes** Dejean.

The holotype of **Galerita microcostata** Darlington (1934–124), a large, dull, dark purplish-brown beetle, five-eighths of an inch long, was collected at Mayagüez, but it has since been found at Quebradillas and Río Piedras.

The type of **Pseudaptinus insularis** Mutchler (1934–4), a much smaller (length 4.5 mm.), yellow brown Carabid, is also from Mayagüez, but it has since been taken at light at San Juan, Ponce and Tortuguero.

Dr. Gundlach lists **Zuphium americanum** Dejean, and there are many unlabeled specimens, handwriting of the person making the determination not recognizable, of these little black Carabids in the Río Piedras Station collection.

The brown **Brachinus brunneus** Castelnau, listed by Drs. Stahl and Gundlach as *Brachinus gilvipes* Mannerheim, has since been collected at Mayagüez, Cartagena Lagoon, Guánica and Ponce, usually at light.

Haliplidae

Dr. E. A. Schwarz identified as **Haliplus** sp., a small, oval, shining, dark brown beetle found in abundance at light, June 8, 1922, under light at Manatí.

Dytiscidae: Predaceous Water Beetles

Aquatic insects were first intensively studied in Puerto Rico by Dr. Stuart T. Danforth when making his ornithological studies at the Cartagena Lagoon. Dr. Julio García-Díaz, in his survey of fresh water insects, collected at Cartegena, Guánica and Tortuguero Lagoons, in the smaller, more inaccessible and less well known lagoons at Cabezas de San Juan: the most northeastern cape of the Island; at La Mina, or the Recreation Area on El Yunque, and in the Río Yúñez at Florida. Most recently,

the mosquito specialists of the U. S. Public Health Service, usually stationed at U. S. Army camps, and those of the local Department of Health, while collecting mosquitoes, have incidentally collected other aquatic insects.

Hydrocanthus iricolor Say is a common continental Dytiscid, 4.0 to 5.0 mm. long, which, to quote Blatchley, is "ovate, convex, attenuate behind; head, thorax and under parts reddish-yellow; elytra dark reddish-brown, polished, iridescent". Dr. Danforth found it at Cartagena, and Dr. Julio García-Díaz lists it in the "Appendix A" to his "Ecological Survey of the Fresh Water Insects of Puerto Rico" (Jour. Agr. Univ. P. R., **22** (1): 94–96. Río Piedras, April 15, 1938), collections having been made at Tortuguero.

Laccophilus proximus Say is locally a much more common species, listed by Drs. Stahl and Gundlach, collected by Dr. Danforth at Cabo Rojo and Luquillo, and by Don Julio at Cartagena and Las Cabezas de San Juan. Shortly after electric lights had been installed in the Forest Service camps on El Yunque, Dr. Luis F. Martorell in June 1935 found it attracted to these lights.

The black or very dark brown, 4.0 mm. long, **Pachydrus brevis** Sharp, **Pachydrus globosus** Aubé and **Pachydrus obniger** Chevrolat, as identified by Mr. J. A. Mutchler, were all collected and are listed by Don Julio, altho his reserve collection contains no specimens to indicate specific localities. Judging by the abundance of collections by Dr. Danforth at Mayagüez, Lajas, Cartagena Lagoon and at Humacao, *P. globosus* is the more abundant. Dr. Gundlach lists the latter under the genus *Hyphydus*. Dr. Stahl gives *Hydroporus exilis*, which may be a MS name for one of these.

A species of **Celina**, as determined by Mr. L. L. Buchanan, has been collected at light at Mayagüez.

Copelatus angustatus Chevrolat and **Copelatus posticatus** F., small Dytiscids of which the males have discs on the fore and middle tarsi, have been found in great abundance at many localities by Dr. Stuart T. Danforth. In December 1942, Dr. A. E. Pritchard collected them at Losey Field, on the south coast near Santa Isabel. Dr. Wetmore found that they had been eaten by the wood pewee and the cliff swallow. Possibly the former species is the more abundant, as it is listed by Dr. Gundlach and also by Don Julio. It was collected on Mona Island by Prof. J. A. Ramos "from a small pool near the airfield".

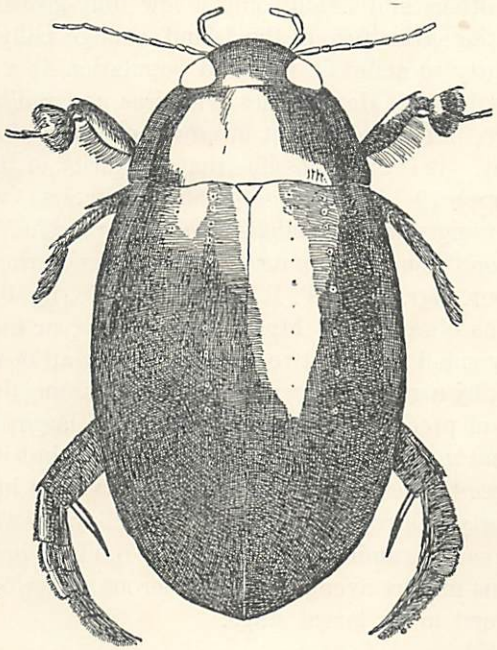
Don Julio lists **Rhantus calidus** F., as determined by Mr. A. J. Mutchler, a new record for Puerto Rico, but since found by Prof. J. A. Ramos (1947–32) on Mona Island.

Eretes stictica L., as determined by Mr. L. L. Buchanan, is an Old World species which occurs in the salt lagoons at Ensenada, Cabo Rojo and Boquerón, where it is presumably predaceous on the maggots of the

Ephydrid fly, *Ephydra gracilis* Packard, or the cosmopolitan crustacean, *Artemia salina*.

Dytiscid beetles identified by Mr. L. L. Buchanan as a species of **Pronoterus** have been collected at light at Mayagüez.

Thermonetus (*Thermonectus* or *Thermonectes* in the earlier records) **basilaris** Harris, **T. circumscripta** Latreille and **T. margineguttata** Aubé average 10.0 mm. in length and half as much in width, black marked with dull yellow, found in all parts of the Island. Dr. Gundlach lists the two



The Giant Predaceous Water Beetle, *Megadytes gigantea* Castelnau, twice natural size. (Drawn by G. N. Wolcott.)

latter under the genus *Acilius*, Dr. Wetmore notes that one had been eaten by the green heron, while all three were collected in fresh water streams by Don Julio, as well as in Cartagena, Tortuguero and the lagoons at Las Cabezas de San Juan. Prof. J. A. Ramos found *Thermonetus circunscripta* on Mona Island.

Megadytes fraterna Sharp, listed by Drs. Stahl and Gundlach under the name *Cybister laevigatus* F., is 20.0 mm. long, almost entirely black except for the lateral margins of the thorax.

Megadytes gigantea Castelnau, listed by Drs. Stahl and Gundlach as *Cybister l'herminieri* Guérin-Méneville, is almost twice as large, making it by far the largest of all the water beetles. Mostly a smooth but not

shining black, its prothorax and elythra are laterally margined with dull orange-yellow, and the hairs of its powerful hind legs are purplish. Previously not too common, the introduction of the giant Surinam toad, *Bufo marinus* L., by providing such an abundant food supply of pollywogs, in recent years has greatly increased its numbers. One sometimes notes a lily pond or other pool well stocked with the eggs of this toad, and a few days later great numbers of tadpoles, but their number very rapidly decreases until one soon finds only the ferocious larvae of this water beetle now devouring each other, and finally only a few fully-grown ones are left. Fortunately for the agriculture of the Island, enough pollywogs have survived until recently to maintain the toad population at a maximum that can be sustained by the May beetles, vaquitas and millipedes available for its sustenence, but certainly not in any pool where the larvae of this beetle are present. It is quite possible that the rarity of the native toads, *Bufo lemur* (Cope) (= *Peltaphryne gutturosus* Peters), was due to the difficulty of surviving where *Megadytes gigantea* is present. The minimum length of time for "The Development of the Giant Surinam Toad, *Bufo marinus* L." (Jour. Agr. Univ. P. R., **21** (1): 77–78, fig. 3. Río Piedras, January 1937), as observed by Mr. Francisco Seín, in the tadpole stage from egg to very small adult is two months, during all of which time it is subject to attack by a great number of enemies, including dragon fly larvae as well as those of predaceous aquatic beetles. In large bodies of water, one may hope that many will elude *Megadytes* larvae, but in small pools in which one of these beetles has laid her eggs, observation indicates that all perish. Of the fifty bullfrogs, *Rana catesbeiana* Shaw, of which Mr. Mario Pérez made stomach examinations, one large bullfrog had eaten one of these beetles, thus in part avenging the numerous pollywogs which it had doubtless consumed in its larval stage.

Gyrinidae: Whirligig Beetles

Whirligig beetles are by no means as often seen in pools and the quiet reaches of streams in Puerto Rico as in North America, but at least four species are present. From the mountains, a local subspecies, **portoricensis**, has been described by Mr. G. Ochs (Amer. Museum Novitates No. 125, pp. 8. New York, July 24, 1924) of the shining black **Dineutus longimanus** Olivier of Cuba.

The common coastal form, shining metallic, not black, **Dineutus metallicus** Aubé, was noted by Drs. Stahl and Gundlach, and has often been collected since, Don Julio having specimens from Cabezas de San Juan, Florida and Isabela.

Dineutus americanus Aubé, as identified by Mr. L. L. Buchanan, was collected in a pool near what is now Punta Borinquen Air Base by Dr. Luis

F. Martorell. The apex of its elytra is rounded, that of *D. longimanus* sharply angled.

Gyrinus rugifer Régimbart, originally described from Guadaloupe and later found in Dominica, has since been collected at Aibonito in Puerto Rico and at other places in the mountains, as well as by Don Julio at Bayamón, Florida and at Tortuguero Lagoon. It is the smallest of the whirligig beetles in Puerto Rico, only a fifth of an inch long, black with bluish and metallic reflections.

Catopidae

Dissochaetus portoricensis was described as a *Choleva* by Mr. M. H. Hatch in "Studies on the Leptodiridae (Catopidae), with description of a new species" (Jour. N. Y. Ent. Soc., **41** (1–2): 187–239, pl. 1. New York, 1933) from the type collected on El Yunque.

Limnebiidae

Uncounted millions of minute little yellowish beetles, determined by Dr. E. A. Schwarz as a species of **Ochthebius**, were flying about in the early morning of February 14th, 1913 at Santa Isabel, and Dr. Stuart T. Danforth in November 1930 made comparable collections at Cabo Rojo.

Ptiliidae

Despite the minute size of Ptiliid beetles, the intensive intercepting of Mr. R. G. Oakley at Ponce adds the record of **Acratrichis haldemanni** LeConte, as determined by Mr. H. S. Barber, on *Inga vera*, and this or other species on dung and in rotten cacao pods at Mayagüez to the Leng & Mutchler record of **Acratrichis atomaria** DeGeer.

Scydmaenidae

From both St. Thomas and Puerto Rico are recorded the very small, shining, oval, convex Scydmaenid beetles: **Euconnus amoenus** Reitter, **Euconnus coralinus** Reitter, **Euconnus tantillus** Reitter and **Euconnus testaceous** Schaum. Mr. R. G. Oakley intercepted one of these at Villalba.

Pselaphidae

Herr Edm. Reitter in "Beitrag zur Kentniss der Clavigeriden, Pselaphiden und Scydmaeniden von Westindien" (Deutsche Ent. Zeitschr., **27** (1): 33–46. Berlín, 1883) describes as *Trimiopsis*: **Melba eggersi, Melba parmata** and **Melba ventricosa**, of which the types were collected in Puerto Rico.

M. Ch. Aubé in his "Revision de la Familie des Pselaphiens" (Ann. Soc.

Ent. France, 2 Serie, 2: 120. Paris, 1844) describes **Reichenbachia eucera** from the type collected in Puerto Rico.

Scaphidiidae

Mr. H. G. Barber determined a small beetle intercepted by Mr. R. G. Oakley in decaying wood at Añasco as a species of **Scaphosoma**.

Staphylinidae

Dr. Richard E. Blackwelder in his "Monograph of the West Indian Beetles of the Family Staphylinidae" (Bulletin No. 182, U. S. National Museum, pp. 658, fig. 3, maps 19, bibliography. Washington, D. C., 1943) records 103 Staphylinids from Puerto Rico, 3 from Vieques, one from Culebra and one from Mona. Prof. J. A. Ramos found a *Xantholinus* on fresh cow dung on Mona, and also "numerous small undetermined Staphylinids on fungi at Sardinera Beach". The Puerto Rican species are:

1. *Piestus penicillatus* (Dalman)
   (as *erythropus* Erichson) Stahl IP & IB
   Blackwelder 43-46: at Utuado and on El Yunque.
2. *Phloeonomus pedicularius* Erichson (as *Omalium*) 40-887: TYPE from Puerto Rico
   (as *Omalium*) Leng & Mutchler IP & IB
   Blackwelder 43-52: no new records from PR.
   (as sp.—det W. S. Fisher) larvae and adults on gummy exudate from aceitillo, *Zanthoxylum flavum*, at Guánica (148-40, 79-40).
3. *Carpelimus fulvipes* Erichson (as *Trogophloeus*) 40-804: TYPE from Puerto Rico
   (as *Trogophloeus aequalis* J. Duval) Gundlach 93-100
   (as *Trogophloeus*) Leng & Mutchler IP & IB
   Blackwelder 43-62: from Isabela (WAH), Jayuya (Oakley), Bayamón (Mills), Maricao, Guanica and Cartagena Lagoon.
4. *Carpelimus correctus* Blackwelder 43-64: at Maricao.
5. *Carpelimus borinquensis* Blackwelder 43-70: TYPE from Maricao Insular Forest, others from El Yunque, P. R. (Darlington).
6. *Carpelimus danforthi* Blackwelder 43-71: TYPE from under rubbish on muddy bank of Guánica Lagoon, others at Ensenada, P. R.
7. *Carpelimus imitator* (Bierig)
   Blackwelder 43-72: at Utuado (Busck), Jayuya (Oakley), Guánica (Darlington), Maricao and Mayagüez.
8. *Carpelimus aridus* (DuVal)
   (as *Trogophloeus*) Gundlach IP & IB
   Blackwelder 43-73: at Guánica.
9. *Carpelimus petomus* Blackwelder 43-76: at Guánica, P. R., and from Vieques Id. (Leonard).
10. *Carpelimus flavipes* (Erichson)
    Blackwelder 43-77: at Guánica and Mayagüez, P. R.

11. *Carpelimus scrobiger* (Cameron)
Blackwelder 43-76: from Vieques Id. (Busck), and at Aguadilla and Utuado, P. R. (Busck).
12. *Oxytelus insignitus* Gravenhorst
Blackwelder 43-92: at Aguadilla (Busck), Ponce (Dozier), Matrullas, Maricao, Villalba, Mayagüez and San Juan, P. R.
13. *Oxytelus incisus* Motschulsky
Blackwelder 43-96: at sixteen Puerto Rican localities.
14. *Oxytelus eremus* Blackwelder 43-98: TYPE from Guanajibo (Mayaguez), Puerto Rico (Dozier).
15. *Oxytelus scorpio* Fauvel
Blackwelder 43-99: at Maricao.
16. *Thinobius nitidulus* Bernhauer
Blackwelder 43-109: on El Yunque (Darlington).
17. *Platystethus spiculus* Erichson
Blackwelder 43-110: at Ponce (Dozier), Hormigueros, Humacao and San Juan, P. R.
18. *Bledius beattyi* Blackwelder 43-117: from Vieques Id. (Leonard).
19. *Pseudolispinodes danforthi* Blackwelder 43-125: TYPE from under bark of rotting logs at Mayagüez, P. R.
20. *Pseudolispinodes tenellus* Erichson (as *Lispinus*) 40-830: TYPE from St. John and Puerto Rico.
Blackwelder 43-126: on El Yunque.
21. *Lispinus laticollis* Erichson
Fauvel 63-442. Leng & Mutchler IP & IB
Blackwelder 43-131: no new P. R. records.
22. *Lispinus attenuatus* Erichson 40-828: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-134: on El Yunque (Darlington) and at Mayagüez.
23. *Lispinus insularis* Fauvel
Blackwelder 43-136: at Fajardo (Busck).
24. *Espeson moratum* Schaufuss
Blackwelder 43-146: on El Yunque (Darlington).
25. *Thoracophorus simplex* Wendeler
Blackwelder 43-149: at Adjuntas and Mayagüez.
26. *Thoracophorus brevicristatus* (Horn)
Blackwelder 43-150: at Mayaguez.
27. *Thoracophorus guadalupensis* Cameron
Blackwelder 43-151: at Mayaguez.
28. *Thoracophorus denticollis* Erichson (as *Glyptoma*) 40-910: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-154: no new records from Puerto Rico.
29. *Paralispinus exiguus* Erichson (as *Lispinus*) 40-830: TYPE from Puerto Rico.
(as *Ancaeus*) Leng & Mutchler IP & IB
Blackwelder 43-158: at Mayaguez.
30. *Paralispinus crepusculus* Blackwelder 43-160: at Fajardo (Busck).
31. *Paralispinus punctatus* Blackwelder 43-161: TYPE from El Yunque, Puerto Rico (Darlington).

32. *Neotrochus cylindrus* Erichson (as *Holotrochus*) 40-758: TYPE from Puerto Rico.
(as *Holotrochus*) Leng & Mutchler, IP & IB
Blackwelder 43-167: no new records from Puerto Rico.
33. *Holotrochus volvulus* Erichson 40-758: TYPE from Puerto Rico.
Blackwelder 43-171: from El Yunque (Darlington), and at Ponce and Adjuntas (Oakley). in dung
(as sp.) in rotten wood at Mayagüez (I. No 6361), at Añasco (I No 6238).
34. *Mimogonus fumator* (Fauvel)
Blackwelder 43-172: at Lajas (Dozier) and at Juana Díaz (Oakley), also intercepted at New York in soil from Puerto Rico.
35. *Osorius laeviceps* Notman, Howard, "A synoptic Review of the Beetles of the Tribe Osoriini from the Western Hemisphere." Proc. U. S. Nat. Museum, *67* (11): 1–26. Washington, D. C., 1925: TYPE from San Juan, Puerto Rico.
Blackwelder 43-195: from El Yunque (Darlington), and at Adjuntas, Maricao and Mayagüez.
36. *Osorius eggersi* Bernhauer
Blackwelder 43-196: one record from Puerto Rico.
37. *Lithocharis sororcula* Kraatz
Blackwelder 43-241: at Lajas and Boquerón (Dozier), San Juan and Salinas
38. *Lithocharis ochracea* (Gravenhorst)
Gundlach IP & IB
Blackwelder 43-242: at Lajas, Guánica and Ponce (Dozier), at San Juan and Salinas.
39. *Lithocharis secunda* Blackwelder 43-244: at Salinas.
40. *Lithocharis volans* Blackwelder 43-245: at Salinas.
41. *Lithocharis limbata* Erichson
Blackwelder 43-246: at Villalba, Mayagüez and San Juan.
42. *Lithocharis dorsalis* Erichson 40-616: TYPE from Puerto Rico.
Leng & Mutchler. IP & IB
Blackwelder 43-247: at San Germán (Dozier), at Villalba, Maricao and Adjuntas.
43. *Lithocharis posticata* Erichson 40-619: TYPE from Puerto Rico.
Leng & Mutchler. IP & IB Blackwelder 43-249: no new record.
44. *Aderocharis suturalis* Blackwelder 43-254: TYPE from horse manure and flying at dusk near Villalba, Puerto Rico, others from Ensenada (Dozier) and Adjuntas.
45. *Stilomedon audanti* Blackwelder 43-258: At Ponce, P. R. (Dozier).
46. *Sunius oakleyi* Blackwelder 43-261: TYPE from rotten stump at Adjuntas, Puerto Rico, others from Maricao Insular Forest and on El Yunque (Darlington).
47. *Scopaeus fasciatellus* Erichson 40-609: TYPE from Puerto Rico.
Leng & Mutchler IP & IB Blackwelder 43-283: at Ciales.
48. *Scopaeus antennalis* Cameron
Blackwelder 43-284: at Jayuya (Oakley).
49. *Scopaeus pygmaeus* Erichson 40-608: TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-287: at Jayuya (Oakley) and at Guánica.

50. *Rugilus chthonus* Blackwelder 43-304: TYPE from dead leaves at Villalba, Puerto Rico.
51. *Lathrobium subterraneum* Blackwelder 43-311: TYPE from ground cover at El Yunque, Puerto Rico (Darlington).
52. *Lobrathium borinquense* Blackwelder 43-319: TYPE in ground cover at El Yunque, Puerto Rico (Darlington).
53. *Homoeotarsus albipes* (Erichson) 40-566 (as *Cryptobium*): TYPE from Puerto Rico.
    (as *Cryptobium*) Leng & Mutchler IP & IB
    Blackwelder 43-328: at Bayamón (Lesesnes).
54. *Biocrypta fulvipes* (Erichson) 40-566 (as *Cryptobium*): TYPE from Puerto Rico.
    (as *Cryptobium*) Leng & Mutchler IP & IB
    Blackwelder 43-337: on El Yunque and in Maricao Insular Forest (Darlington), and at Villalba, from damp leaves.
55. *Stilosaurus lineatus* Blackwelder 43-349: TYPE from El Yunque, Puerto Rico (Darlington).
56. *Stamnoderus labeo* (Erichson)
    Blackwelder 43-352: on El Yunque (Darlington) and at Villalba.
57. *Stiliphacis exigua* (Erichson) (as *Sunius exiguus*) 40-647: TYPE from Puerto Rico.
    (as *Stilicopsis*) Leng & Mutchler IP & IB: on cucumbers at Jayuya, (I No 3735 det. as "sp." E. A. Chapin).
    Blackwelder 43-356: no new record from Puerto Rico.
58. *Pinophilus danforthi* Blackwelder 43-378: TYPE from Humacao, Puerto Rico (Miguel A. Díaz).
59. *Pinophilus bierigi* Blackwelder 43-382: TYPE from Mayagüez, Puerto Rico (A. Suro).
60. *Pinophilus flavipes* Erichson 40-674: TYPE from Puerto Rico.
    Leng & Mutchler. IP & IB Danforth: at Humacao xi–30 det. Mutchler.
    Blackwelder 43-383: no new records from Puerto Rico.
    Pinophilus latipes Gravenhorst/Gundlach Stahl IP & IB
61. *Palaminus bifidus* Notman 29-14: TYPE from El Yunque, others from Aibonito and Adjuntas, P. R. IB Blackwelder 43-389: no new record.
62. *Palaminus grandicollis* Notman 29-16: TYPE from Aibonito, other from Adjuntas, P. R.
    IB Blackwelder 43-390: no new record.
63. *Palaminus insularis* Cameron
    Notman 29-17: at Aibonito. IB Blackwelder 43-390: no new record.
64. *Palaminus lengi* Notman, Howard, "New Species of *Palaminus* from the West Indies, together with a Synoptic Review of the Genus." Amer. Museum Novitates No. 386, pp. 17. New York, November 27, 1929: TYPE from Adjuntas, P. R.
    Blackwelder 43-391: at Mayagüez (Dozier) and Adjuntas (Oakley).
65. *Palaminus parvipennis* Notman 29-14: TYPE from El Yunque, P. R., others from Loíza.
    Blackwelder 43-391: from Mayagüez (Dozier) and Villalba.
66. *Palaminus procerus* Notman 29-16: TYPE from Aibonito, P. R.
    IB Blackwelder 43-392: from Maricao (Morrison).

67. *Palaminus pusillus* Notman 29-15: TYPE from El Yunque, P. R.
IB Blackwelder 43-392: "only the unique type."
68. *Palaminus scitulus* Notman 29-15: TYPE from Aibonito, P. R.
IB Blackwelder 43-392: "only the two types."
69. *Palaminus variabilis* Erichson 40-683: TYPE from Colombia, Puerto Rico and St. Thomas.
Blackwelder 43-393: no new records from Puerto Rico.
70. *Paederomimus lustralis* (Erichson) (as *Philonthus*) 40-489: TYPE from Puerto Rico.
Leng & Mutchler IP & IB Blackwelder 43-398: no new records.
71. *Philonthus hepaticus* Erichson
Blackwelder 43-401: at Guánica (Smyth), at Lajas and Hormigueros (Dozier), and at Maricao, Adjuntas and San Juan.
common in and under both stale and fresh cow droppings, at Guánica (545-13).
72. *Philonthus thermarum* Aubé
Blackwelder 43-403: at Lajas, Guánica, Sabana Grande and Boquerón (Dozier), and at Maricao.
73. *Philonthus ventralis* (Gravenhorst)
Blackwelder 43-404: at Lajas, Ensenada and Juana Díaz (Dozier), from Culebra Id. (Busck), and at Guánica, Cartagena Lagoon, Adjuntas, Humacao, Mameyes and San Juan in Puerto Rico.
74. *Philonthus discoideus* (Gravenhorst)
Blackwelder 43-407: at San Juan.
75. *Philonthus figulus* Erichson
Blackwelder 43-409: at Maricao.
76. *Philonthus longicornis* Stephens
Blackwelder 43-410: at Lajas (Dozier).
77. *Philonthus havaniensis* (Laporte)
(as *P. trepidus*) Erichson 40-489: TYPE from Puerto Rico and St. John.
Leng & Mutchler IP & IB
Blackwelder 43-418: at Guánica, Maricao and Mayagüez.
Philonthus alumnus Erichson
Leng & Mutchler IP & IB IB Sup-85: (as "Sp.") in cacao pods at Mayaguez (I No. 6370), and in guavas (I No. 6381); at light at Palo Saco (I No. 6564).
78. *Belonuchus oakleyi* Blackwelder 43-422: TYPE "in a mass of rotting fruit" at the base of an imported palmlike tree at Mayagüez. Puerto Rico.
79. *Belonuchus gagates* Erichson 40-424: TYPE from Puerto Rico.
Leng & Mutchler IP & IB: on orange fruit at Ponce (I No. 2659).
Blackwelder 43-424: at Bayamón (Busck), Juana Díaz, Ensenada and Mayaguez (Dozier), and at Maricao, Mayagüez, San Juan and on El Yunque.
80. *Belonuchus danforthi* Blackwelder 43-429: TYPE from rotting guava fruit at Maricao, Puerto Rico.
81. *Cafius subtilis* Cameron
Blackwelder 43-436: at San Juan under seaweed and drift on sandy beaches.

82. *Cafius caribeanus* Bierig
Blackwelder 43-437: at San Juan and Humacao under seaweed.
83. *Cafius bistriatus* (Erichson)
Blackwelder 43-438: at San Juan under seaweed, and from Mona Id. (Hoffman).
84. *Erichsonius humilis* Erichson 40-512 (as *Philonthus*): TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-441: at Jayuya (Oakley).
85. *Diochus nanus* Erichson
Blackwelder 43-455: at Maricao.
86. *Holisus debilis* Erichson
Blackwelder 43-461: on El Yunque.
87. *Holisus guildingii* Erichson
Blackwelder 43-462: at Mayagüez and on El Yunque.
88. *Atanygnathus laticollis* (Erichson)
Blackwelder 43-472: at Mayaguez.
89. *Xantholinus oakleyi* Blackwelder 43-476: TYPE in dung and manure, 13 miles east of Maricao, other from Villalba.
90. *Xantholinus attenuatus* Erichson 39-330: TYPE from St. Thomas and Puerto Rico.
Leng & Mutchler Merrill 15-54: in fresh cow dung.
(as sp.) Wolcott 24-17, 29: eaten by *Anolis pulchellus* and *A. cristatellus*.
Blackwelder 43-478: twenty-three records from Puerto Rico.
at Guánica (545-13 det. E. A. Schwarz, confirmed R. E. Blackwelder).
91. *Xantholinus humeralis* Erichson
Blackwelder 43-479: at San Germán (Dozier) and Maricao.
92. *Xantholinus illucens* Erichson
Blackwelder 43-488: at thirteen Puerto Rican localities.
93. *Leptacinus parumpunctatus* (Gyllenhal)
Blackwelder 43-494: at Lajas and Yauco (Dozier).
94. *Leucoparyphus silphoides* (Linnaeus)
Blackwelder 43-510: at Salinas.
95. *Coproporus apicalis* (Erichson) 39-250 (as *Tachinus*): TYPE from Puerto Rico.
(as *Erchomus apicalis*) Leng & Mutchler IP & IB
Blackwelder 43-514: no new records from Puerto Rico.
96. *Coproporus hepaticus* (Erichson)
(as *Cilea*) Leng & Mutchler IP & IB
Blackwelder 43-514: at Cayey (Cotton), Bayamon (Lesesne), and San Juan.
under bark of decaying bucare trees at Cayey (307-17 det. R. E. Blackwelder).
97. *Coproporus flavicollis* Scriba
(as *Tachinus nitidulus*) Erichson 39-247: TYPE from Puerto Rico.
(as *Erchomus nitidulus*) Leng & Mutchler IP & IB
Blackwelder 43-518: no new record from Puerto Rico.

98. *Coproporus ebonus* Blackwelder
(as *Tachinus piceus*) Erichson 39-246, 250: TYPE from Puerto Rico.
(as *Erchomus piceus*) Leng & Mutchler IP & IB
Blackwelder 43-519: at Adjuntas.

99. *Coproporus pulchellus* (Erichson) 39-247 (as *Tachinus*): TYPE from Puerto Rico.
(as *Cilea*) Leng & Mutchler IP & IB
Blackwelder 43-520: no new Puerto Rican record.
in guavas at Mayaguez (I No. 6383 det. E. A. Chapin).

100. *Coproporus rutilus* (Erichson) 39-522 (as *Tachinus*): TYPE from Puerto Rico.
(as *Cilea*) and (as *Coproporus terminalis* Erichson), not in synonymy Leng & Mutchler IP & IB
Blackwelder 43-522: at Ponce (Oakley).

101. *Conosomus interruptus* (Erichson)
Blackwelder 43-525: on El Yunque (Darlington).

102. *Bryoporus obscurus* (Erichson) 39-272 (as *Bolitobius*): TYPE from Puerto Rico.
(as *Bolitobius*) Leng & Mutchler IP & IB
Blackwelder 43-529: no new record from Puerto Rico.
Gyrophaena sp.—det. E. A. Schwarz
IP & IB: common on a fungus, *Daedalea amanitoides* (1221-13).
at Mayagüez (I No. 6371); in cacao pods at Mayagüez (I No. 6378).

103. *Atheta decipula* (Erichson) 39-119 (as *Homalota*): TYPE from Puerto Rico.
Blackwelder 43-551: no new record.

104. *Atheta melanura* Erichson 39-117 (as *Homalota*): TYPE from Puerto Rico.
Blackwelder 43-553: no new record.

105. *Hoplandria terminata* Erichson 39-130 (as *Homalota*): TYPE from Puerto Rico.
Leng & Mutchler IP & IB
Blackwelder 43-557: no new record.

106. *Phloeopora religata* (Erichson) 39-79: TYPE from Puerto Rico.
Blackwelder 43-558: no new record.
Aleochara sp. nov.—det. E. A. Schwarz
in cow dung at Guanica (GBM).

Hydrophilidae: Water Scavenger Beetles

Hydrochus pallipes Chevrolat, listed by Dr. Gundlach and found by Dr. Wetmore to have been eaten by the tody, has not since been collected.

The dark brown **Berosus interstitialis** Knisch (= *B. tesselatus* F. & S.) and the light brown, spotted, 5.0 mm. long **Berosus guadeloupensis** Fletiaux & Sallé, Dr. Wetmore found eaten not only by the tody, but also by the cliff swallow, the blue heron and sandpipers. The former is presumably somewhat more abundant, as Dr. Danforth has specimens from Cartagena Lagoon, Cabo Rojo, Añasco, Coamo and Tortuguero; Dr. A. E. Pritchard from the swamps near Santa Isabel, and Prof. J. A. Ramos from Mona Island. Don Julio reports both species of the latter, as identified by Mr.

A. J. Mutchler, of which large numbers were found in the pools at Isabela, Dr. Danforth had specimens from Mayaguez and Rio Piedras.

The smooth, shining, oval, black **Tropisternus lateralis** F. (= *T. nimbatus* Say), 8.5 mm. long, its thorax and elytra narrowly margined with yellow, was listed by Drs. Gundlach and Stahl, and found by Dr. Wetmore to form part of the food of the little blue heron. Many collections were made by Dr. Danforth; Dr. Pritchard found it in the swamps around Santa Isabel, and it is listed by Don Julio, whose collection contains hundreds of specimens: from chacras at Isabela, from Guánica and Cartagena Lagoons and those at Las Cabezas de San Juan. It occurs not only on Culebra and Mona Islands, but also in the most of the other Antilles, and continentally from New York to the Argentine.

Tropisternus chalybeus Castelnau, as identified by Mr. W. S. Fisher, is represented by a single specimen collected at light at San Juan.

Tropisternus collaris F., with striped elytra, was listed by Drs. Gundlach and Stahl. Dr. H. L. Van Volkenberg, while working as Parasitologist at the Mayagüez Station in 1930 and 1931, discovered that this beetle was the host of a tapeworm cysticercoid, and of the thorny-headed worm, *Macracanthorhynchus hirudinaceus*, of swine. It is a common aquatic beetle in Puerto Rico, collected at many points by Dr. Danforth and Don Julio, but present also in the other Antilles and continentally from Mexico to the Argentine.

Neohydrophilus medius Brullé (= *N. tenebrioides* DuVal) and **Neohydrophilus phallicus** d'Orchymont are similar, smooth, shining black beetles, averaging five-eights of an inch in length. Drs. Gundlach and Stahl reported the former as a *Hydrous*, and Dr. Wetmore found them eaten by the little blue heron. Individuals fly to lights, but most collections have been made in lagoons, pools or streams. One species, presumably the former, has two punctures on the prothroax; that of the other is impunctate.

Largest of all the Hydrophilidae is **Hydrophilus insularis** Castelnau, almost an inch and a half in length, equaling in length *Megadytes gigantea* Castelnau, but considerably slimmer, and with even more highly polished black elytra. Not especially abundant, it was listed by Drs. Gundlach and Stahl, and is found on Mona as well as in most of the Antilles and continentally from Texas to the Argentine.

Much more abundant and decidedly smaller, but otherwise similar in appearance, is **Hydrophilus ater** Olivier, a continental form, of which the subspecies **intermedius** DuVal only is found in the Antilles. Dr. Wetmore notes that it had been eaten by the little blue heron, and Mrs. Raquel Dexter, by the introduced toad. Leng & Mutchler report it from Culebra

Island as a *Stethoxus*, and it has also been identified as a *Hydrous*, but Drs. Stahl and Gundlach list it under the at present preferred name.

Mr. Hugh B. Leech identifies as **Helochares rufobrunneus** Balfour-Browne "a plain dark brown beetle, like a large Enochrus; 7.0 mm. long; no elytral striae and virtually impunctate", of which numerous adults came to light at Río Piedras on May 20th, 1943. It has not been previously reported from Puerto Rico.

As *Philhydrus melanocephalus* F., Dr. Gundlach reports what is presumably the little brown, 3.0 mm. long **Enochrus ochraceus** Melsheimer, of which Don Julio's collection contains specimens from the streams on El Yunque and hundreds from Cartagena Lagoon. Or, it may refer to the much more common **Enochrus nebulosus** Say, of which Dr. Danforth has specimens from all parts of the Island, and Prof. J. A. Ramos (1947–32) many from Mona. Dr. Wetmore reports these beetles as being eaten by the killdeer.

Phaenonotum estriatum Say is a very convex, small, shining, dark reddish-brown beetle, 3.0 mm. long, sometimes coming to light, and in the field found in abundance in cane trash, and also in decaying fig fruits. As it was noted as an item in the food of the crested and the small yellow grass lizards, presumably it is in reality much more abundant than the scarcity of collection records would indicate.

Dactylosternum flavicorne Mulsant is listed by Drs. Stahl and Gundlach as a *Cyclonotum*. Leng & Mutchler list **Dactylosternum advectum** Horn, and Mr. A. J. Mutchler identified for Dr. Danforth numerous specimens of **Dactylosternum picicorne** Mulsant from Yabucoa, Ponce, Luquillo, Río Piedras and Mayagüez.

Dactylosternum abdominale F. is apparently the common species in Puerto Rico: 4.0 mm. long, and almost as broad, a reddish-brown to almost black beetle with very marked elytral striae. It is an item in the food of the lizards in the mountains, where it occurs under the bark of trees, in decaying figs, in decaying cacao pods and in the trash of banana plants.

In the course of his fresh water insect survey, Don Julio García-Díaz collected **Phaenotypus palmarum** Schwarz, and also **Paracymus subcupreus** Say, both identified by Mr. A. J. Mutchler, the latter with some doubt, all specimens being retained by him. Both are new records for Puerto Rico.

Dr. Wetmore reports a species of **Cercyon** eaten by a cliff swallow, and Prof. J. A. Ramos found one at light on Mona Island. Recent interceptions made in dung at Adjuntas and in rotten cacao pods at Mayagüez have been re-identified as species of **Pelosoma** not *Oösternum costatum* Sharp, as previously reported.

Monoedidae

Mr. W. S. Fisher identified as a species of **Monoedus** a small beetle intercepted by Mr. R. G. Oakley on chinaberry tree at Adjuntas.

Histeridae: Hister Beetles

The small, hard, black shining Hister beetles, usually tending to be round and flattened, are supposed to have derived their name from the Latin word histrio, meaning clown or mimic. The best known member in Puerto Rico is an introduced East Indian species, **Plaesius javanus** Erichson, which is predaceous on the immature stages of the banana corm weevil, *Cosmopolites sordida* Germar. In captivity in Puerto Rico, the adult Histerids fed on both larvae and pupae of the introduced pest of bananas, but no trace has since been found to indicate that any survived of those released in a banana grove at Adjuntas.

Including its prominent projecting jaws, **Hololepta 4-dentatum** F. is 11.0 mm. long, making it possibly the largest local Histerid in Puerto Rico. Hardly half the abdomen is covered by the transversely truncate elytra, which have basaly two lateral striae. Dr. Richard T. Cotton found it abundant under the bark of dead bucare trees at Cayey, and it has since been collected at Mayagüez. As *Lioderma ruptistriata* Marseul, Dr. Gundlach listed **Hololepta interruptum** Marseul, a somewhat smaller but brightly polished species, which Dr. Cotton collected under the bark of bucare trees, and also in grapefruit groves.

Of **Acritus analis** Leconte, Dr. Gundlach writes, "muy pequeña (no pasa de 1.0 mm. en longitud)". It has since been identified by Dr. E. A. Schwarz from specimens found in cow dung at Guánica.

Carcinops dominicana Marseul is a small metallic green beetle, collected by Dr. R. T. Cotton under bark of bucare trees at Cayey. **Carcinops troglodytes** Paykull, listed by Dr. Gundlach, has not since been found locally.

Prof. J. A. Ramos (1947–32) reports collecting on dead birds on Sardinera Beach, Mona Island, "numerous small, black, shining undetermined histerids", which have since been identified by Mr. H. S. Barber as species of **Saprinus.**

Types of **Epierus antillarum**, collected in Puerto Rico, Hispaniola and Cuba were described by S. A. de Marseul in his "Essai Monographique sur la Familie des Histerides" (Ann. Soc. Ent. France, Series 3, **2:** 671–707. Paris, 1854), in which is listed his **Epierus waterhousei** from Puerto Rico.

From material sent him by Dr. Gundlach, M. de Marseul named after Herr Leopoldo Krug what most unfortunately was mis-spelled **Omalodes klugi**: a large, almost circular Histerid, repeatedly collected since in the mountains back of Mayagüez by Dr. Danforth and his students, dozens being found in decaying bananas at Maricao. Prof. J. A. Ramos has a single specimen from Mona Island. Other specimens of what may be the same species, some of which were identified by Dr. E. A. Schwarz as **Omalodes ruficlavis** Marseul have been found under bark of decaying

bucare trees at Cayey, in coffee groves at Villalba and at El Verde (Río Grande), in grapefruit grove at Manatí, and in flight or at light at Guánica and Salinas. They vary in size from 6.0 to 8.0 mm. long, usually so highly polished that they look as tho they might be sticky to touch.

The elytra of beetles belonging to the genus Hister normally have nine striae. Mr. H. S. Barber has identified as **Hister confinis** Erichson, 3.0 mm. long, and as **Hister coenosus** Erichson, 5.0 mm. long, the less shiny beetles collected in dung in numerous localities of Puerto Rico.

Lucanidae: Stag Beetles

Paxillus pentaphyllus Palisot de Beauvois, an inch long, and quarter of an inch wide, is a flattened, reddish-brown to black beetle, with stout antennae, the outer segments of which are "leaf-like, but not capable of being opposed or folded together into a compact club,—therefore pectinate, or comb-toothed, rather than lamellate" according to Blatchley. It occurs most often in the mountains, the larvae living in rotten wood, all sizes being found, together with adults, in logs that have reached just the right stage of decay. This was one of the insects first noted in Puerto Rico, by the Botanist Ledru in 1780.

Ledru also listed as *Passalus dentatus* Fabricius what is now called **Paxillus puncticollis** Serville, another member of the family later collected by Dr. Gundlach in the western end of the Island.

Paxillus crenatus MacLeay is smaller and more convex, with similar habits and habitat, but present also in the Luquillo Mountains.

Scarabaeidae: Lamellicorn Beetles

Despite several attempts to introduce and establish coprophagid or dung-rolling beetles, to dispose promptly of fresh cow dung so that it would not serve as host for horn-fly larvae, no representative of any of the introduced species has been found here since release. Shortly after the establishment of the Sugar Producers' Experiment Station at Río Piedras, Mr. J. D. Mitchell of Victoria, Texas, sent 275 adult beetles, of which 146 arrived in Porto Rico alive, of three species: *Canthon ebenus* Say, *Canthon laevis* Drury and (what is now known as) *Ateuchus lecontei* (Harold) (originally identified as a *Choeridium* by Dr. W. Dwight Pierce). About a hundred beetles of *Canthon violaceus* Olivier were brought from Santo Domingo by G. B. Merrill, and 8 adults of *Copris carolina* Linn. were sent by the writer from Randolph, Illinois. These beetles were kept in large outdoor screen cages at Guánica, supplied with fresh cow dung daily and they multiplied rapidly in confinement. When the cages became crowded, a liberation of 100 adults at a time would be made. Although the condi-

tions seemed favorable for these beetles, especially those from south Texas and southern Santo Domingo, yet none was noticed in the field after their release, and it is doubtful if any became permanently established in Puerto Rico" ("Insect Parasite Introduction in Porto Rico", Jour. Dept. Agr. P. R., **6** (1): 5–20, fig. 7. San Juan, October 1922). Many years later, additional attempts at establishing dung-beetles from Santo Domingo were made by Dr. H. L. Dozier at Mayagüez, with the same lack of success.

Despite failure of coprophagid beetles from a similar xerophytic environment to become established in southwestern Puerto Rico, native species do occur on the Island, but apparently only in the mountains. Mr. R. G. Oakley, a very keen collector of hitherto unknown insects, when stationed at Ponce as representative of the Federal Horticultural Board, found five new species of such beetles, one of which Dr. Chapin named after him. Ragged by other Plant Quarantine Inspectors stationed at that time in Puerto Rico about having a dung-beetle bearing his name, he requested Dr. Chapin to name the next one he found after one of his tormentors. Unfortunately, the scheme somewhat misfired, as Oakley referred to C. G. Anderson only by his nickname: "Andy", therefore the beetle is **Canthochilum andyi.**

Canthonella parva, described by Dr. E. A. Chapin as the sole known representative of "*Canthonella*, a new Genus of Scarabaeidae (Coleoptera)" (American Museum Novitates No. 409, pp. 2. New York, March 18, 1930), with the type from Coamo Springs, others from Adjuntas, is characterized as being "almost blue-black, the pale spot on the elytron . . . humeral, and the pronotum . . . strongly, densely and moderately coarsely punctate. Length 3.0 mm." Prof. J. A. Ramos has found it under dead leaves in the Maricao Forest.

The type of **Canthochilum oakleyi,** described by Dr. E. A. Chapin as representing "A New Genus and Species of Dung-Inhabiting Scarabaeidae from Puerto Rico, with Notes on the Coprinae in the Greater Antilles (Coleoptera)" (Proc. Biological Soc. Washington, **47:** 99–101. Washington, D. C., June 13, 1934), was found under dung at Adjuntas, others at Aibonito and in the mountains north of Yauco.

The type of **Canthochilum andyi** Chapin ("New Species of Scarabaeidae (Coleoptera) from Puerto Rico and the Virgin Islands" Jour. Agr. Univ. P. R., **19** (2): 67–71. San Juan, October 15, 1935), from Matrullas Dam, near Orocovis, was found under dung, and that of **Canthochilum hispidum** Chapin (1935–67) was from Villalba. The former is piceous to deep black, 5.55 mm. long, the latter with a vestiture of capitate hair and "almost completely covered with a layer of dirt most difficult to remove." Specimens of **Canthochilum histeroides** Harold were intercepted by Mr. R. G.

Oakley at the Pietri finca, Adjuntas, and at Werscheling finca, Ponce, all in or under dung. It is doubtful if any of these is large enough, or occurs in sufficient numbers to be of any appreciable economic importance.

Saprosites blackwelderi, described by Dr. E. A. Chapin (1940–11), the type from rotten wood at Mayagüez, others from Añasco, is 3.0 mm. long, "moderately convex-cylindrical, pronotum slightly wider than elytra at base; castaneous with margins of pronotum and elytra darker."

In xerophytic Puerto Rico, the beetles which are very abundant and notably active in tunneling thru and aerating fresh cow-dung are the oval, shining, yellowish-brown **Aphodius lividus** Olivier, characterized by prothorax and elytra laterally margined by lighter yellowish-brown. This cosmopolitan beetle occurs in all parts of the Island, even the most humid, and in the absence of fresh cow dung may be found living under filter-press cake or "cachaza" from the sugar Centrals. Not recorded by Dr. Gundlach, it may be presumed to have been introduced rather recently thru the agency of commerce in importing live domestic animals from the United States. Dr. Chapin states that "to judge from the fact that *Aphodius lividus* (Olivier) is now generally established from the northern United States to the South Sea Islands, and completely around the world in the tropics and subtropics, climate will play a minor role among the distributional factors." Even at the time that Dr. Wetmore was making his studies on the food of birds in Puerto Rico, it presumably was not common here, for he reports finding it only amid the stomach contents of the ani.

Less abundant in Puerto Rico, smaller and entirely light brown is **Aphodius cuniculus** Chevrolat (= *A. guadeloupensis* F. & S.), specifically recorded from Vieques and the larger Virgin Islands, and noted as "common at light" on Mona Island by Prof. J. A. Ramos, it occurs widely from Mexico to Central America. Some species of *Aphodius* was indicated by Mr. J. A. Stevenson (1915–20) as being attacked by the Green Muscardine fungus, *Metarrhizium anisopliae.* The record of *Aphodius granarius* Linn. from Puerto Rico, recorded by Mr. G. B. Merrill (1915–54) as found in cow manure, is in error, as is also that of this species being eaten by the little grass lizard, *Anolis pulchellus*, altho other species are eaten by these lizards.

In any extensive collection of the beetles found tunneling thru fresh cow dung in Puerto Rico, usually about half are the light yellowish-brown *Aphodius lividus* Olivier, but most of the remainder are a large black species of *Ataenius*, 4.7 to 5.5 mm. long, previously called *Ataenius cognatus* LeConte. Subsequently re-described as *Ataenius darlingtoni* Hinton (1937) from Puerto Rico and St. Croix, it is now considered the "equal of *salutator* Fall (1930), described from Florida. This synonymy was published by Cartwright in Bulletin of the Brooklyn Entomological Society

40: 47 (1945)," according to Dr. E. A. Chapin. Prof. J. A. Ramos found a single specimen of **Ataenius salutator** Fall at light on Mona Island.

Equally large, or larger, and also black is **Ataenius stercorator** F., under which name are recorded the finding by Dr. Wetmore of this and or other species of *Ataenius* beetles eaten by the killdeer, the ani, the owl, the mockingbird and the vireo. Mrs. Raquel Dexter found these beetles eaten by the imported toad, and they have also been found in the stomach of the crested lizard, *Anolis cristatellus*. The animal Parasitologist at the Mayagüez Station, Dr. H. L. Van Volkenberg, found this beetle to be the host of a tapeworm cysticercoid, as was reported more at length by Mr. M. F. Jones & J. E. Alicate in the "Development and Morphology of the Cestode, *Hymenolepis cantaniana*, in Coleopterous and Avian Hosts" (Jour. Washington Academy of Sciences, **25** (5): 237–247. Washington, D. C., May 15, 1935). Dr. Gundlach lists this and the Cuban *rhyticephalus* Chevrolat, as species of *Auperia*, from Puerto Rico.

Dr. E. A. Chapin in "A Revision of the West Indian Beetles of the Scarabaeid Subfamily Aphodiinae" (Proc. U. S. National Museum, **89** (3092): 1–41. Washington, D. C., May 23, 1940) describes **Ataenius beattyi**, 3.5 to 4.0 mm. long, as "sooty black, anterior margins of head and prothorax and legs castaneous," from the Virgin Islands and Barbados. Prof. J. A. Ramos (1947–41) found it on Mona Island.

Dr. E. A. Chapin having examined 1,714 specimens, describes his **Ataenius luteomargo** (1940–36) as "piceous, margins of head and pronotum indefinitely paler, outer two intervals and apices of elytra yellowish to brownish yellow" from Dominica and others of the Lesser Antilles, and present in Puerto Rico, Hispaniola and Jamaica. Previous mis-identifications as *Ataenius terminalis* Chevrolat, which occurs only in Cuba and Jamaica, presumably refer to *luteomargo* in Puerto Rico and the Lesser Antilles.

Under the name **Ataenius gracilis** Melsheimer, Dr. Wetmore records the consumption of Aphodiinid beetles by the green heron and the tody. This slender black species has since been collected from all parts of Puerto Rico as well as from Vieques, having first been listed by Drs. Stahl and Gundlach as *Psammodius gracilis* Jacq. Duval, the latter noting "viene por las noches a las velas de las casas."

The other species of **Ataenius** at present listed as found in Puerto Rico are:

edwardsi Chapin, from Puerto Rico and St. Croix,
frater Arrow, from Puerto Rico and the Virgin Islands,
haroldi Steinheil,
imbricatus Melsheimer, from Puerto Rico and St. Croix,
liogaster Bates ?,

miamii Cartwright, from Mona Island (Ramos 1947–41),
strigicauda Bates, from Puerto Rico and Virgin Islands,
tenebrosus Arrow, from Puerto Rico and Vieques,
versicolor Schmidt, and
vincentiae Arrow.

Psammodius bidens Horn is rare, only one recent collection having been made on the beach at Humacao by Dr. R. E. Blackwelder.

The dull, dirty, yellowish-brown **Trox suberosa** Fabricius is a scant half inch long, a tropicosmopolitan species, noted by Drs. Stahl and Gundlach under the name of *Trox crenatus* Olivier. Mr. C. T. Murphy, of Guánica Centrale, was presumably in error in thinking that it was responsible for damage to sugar-cane that he noted, as it is normally a scavenger, and has been found at Río Piedras under a dead rat. Despite its filthy habits, it is eaten by the none too particular *Bufo marinus*, which it almost exactly matches in color and texture of integument. Possibly most of the beetles collected have been picked up under light. Prof. J. A. Ramos found one on Mona Island, at light.

The introduction of the giant Surinam toad. *Bufo marinus* (L.), has made a greater change in the bulk and composition by bulk of the insect population of Puerto Rico than any other single factor since the clearing of the native forest from the more level portions of the Island in the immediately post-Colombian period. In the cane fields which ever increasingly came to occupy the greater part of the more fertile vegas of Puerto Rico, especially and with increasing rapidity after the occupation by troops of the U. S. Army in the Spanish-American war, a population of native species of white grubs feeding on the roots of sugar-cane and other crops was gradually built up, and finally reached such a peak of abundance as to become the decisive factor in determining whether the growth of sugar-cane or any other crop was possible. In the irrigated land of the south coast which the development of reservoirs in the mountains and the sinking of wells made otherwise suitable for cane growing, white grubs became most abundant, but they were present in destructive abundance everywhere on the Island that agriculture was practised. *White grubs were the major insect pest of every crop grown.* It was to discover some means for the control of white grubs that the Sugar Producers' Association started the Experiment Station at Río Piedras. Numerous other small insects, such as common springtails, aphids or ants might possibly have been numerically more abundant, but certainly in bulk, the white grubs of Puerto Rico greatly overbalanced all the other insects of the Island, not only individually, but all other insects combined. Nowhere else in the world did such an ideal environment await the introduction of *Bufo*, which in its native Guiana must be content to feed on ants and miscellaneous insects.

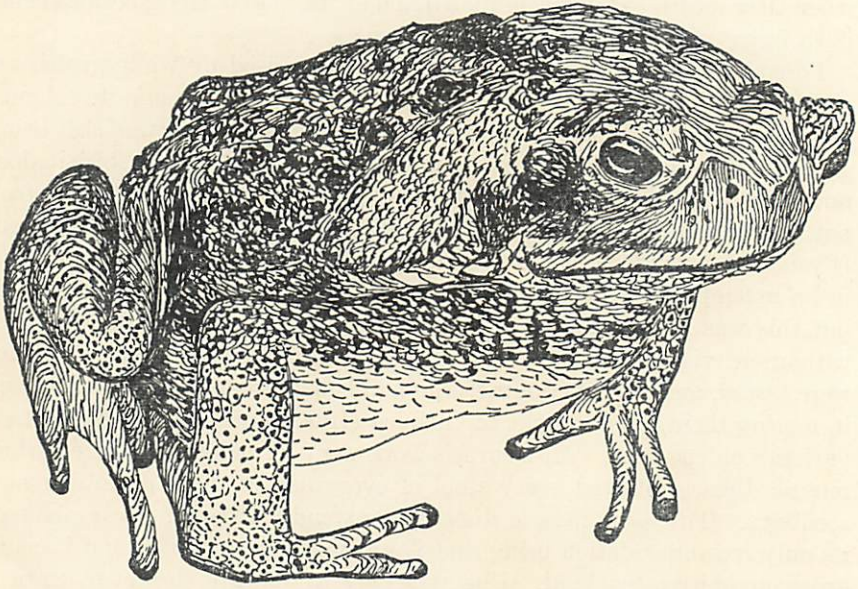
The only parallel is the enormous abundance, reported by R. S. Tohler and A. G. Cooling of individuals of the same "Toads in the Marianas" (Science, **101** (2635): 678. Lancaster, June 29, 1945) following introduction from Hawaii, via Guam, undoubtedly due to a comparable temporarily enormous food supply.

The habits of the May beetles, which are the adults of white grubs, dovetail perfectly with the food requirements of *Bufo*, for they are comparatively slow-moving, terrestrial for two periods each night: when they emerge from the ground to fly to the branches of trees for feeding, and again when they return to burrow in the ground at the base of trees, besides being both large and abundant.

Possibly the greatest damage to sugar-cane caused by white grubs was in the years just before World War I, at Guánica Centrale and its colonos, where Otaheite or White Transparent (Caña Blanca) cane was still being grown. This old variety does wonderfully well in new land, but it does not have a strong root system, and when white grubs completely destroy both rootlets and root-stock, it rots quickly, even before it can be harvested. It was customary for the mill to begin grinding by the middle of December, in an attempt to rescue something from the fields most heavily infested, but this was no solution of the problem. In an attempt to use varieties with more vigorous root systems, those recently developed in Barbados were tested, and Mr. H. Bourne, who had helped the Hon. John R. Bovell in rearing them, was brought to Guánica (Hda. Santa Rita) to breed new varieties on the spot. All Bourne's work went for naught, however, when mosaic disease infected every stool of every one of these promising new seedlings. To escape mosaic disease, the spindly Uba cane was planted, its only recommendation being that it was immune to mosaic and it could grow on unirrigated land. Uba was only a stop-gap, however, until a really superior cane could be found, but the introduction and spread of BH(10)12 a few years later was possible only because the white grub problem was solved (unfortunately, only temporarily, as we now know) by that time.

Mr. D. W. May, Director of the Agricultural Experiment Station at Mayagüez, obtained a few toads from Barbados in 1920, and Mr. R. Menéndez Ramos, Director of the Insular Experiment Station at Río Piedras, brought some in person from Jamaica in the winter of 1923–24. From these two introductions have descended all the toads that had eliminated white grubs from cane fields by a few years later. The shallow lagoons near Guánica, and the smaller irrigation reservoirs and ditches along the remainder of the south coast provided a suitable environment for the development of the immature stages of *Bufo marinus*, and the enormous number of May beetles for months each spring and fall was an apparently

inexhaustible supply of suitable food for the adults, until it was gone. Some of the men at Aguirre claimed that the use of subsoiling Fowler gyrotiller killed the grubs in the soil that it plowed up, but its extensive use merely happened to coincide with the enormous increase in toad population which was the real cause of the disappearance of the white grubs. By 1932, when the Fourth Congress of the International Society of Sugar-Cane Technologists was held in Puerto Rico, the results of the presence of the toad were too obvious to be ignored. · "The Food Habits of the Introduced Toad, *Bufo marinus*, in the Sugar-Cane Sections of Porto



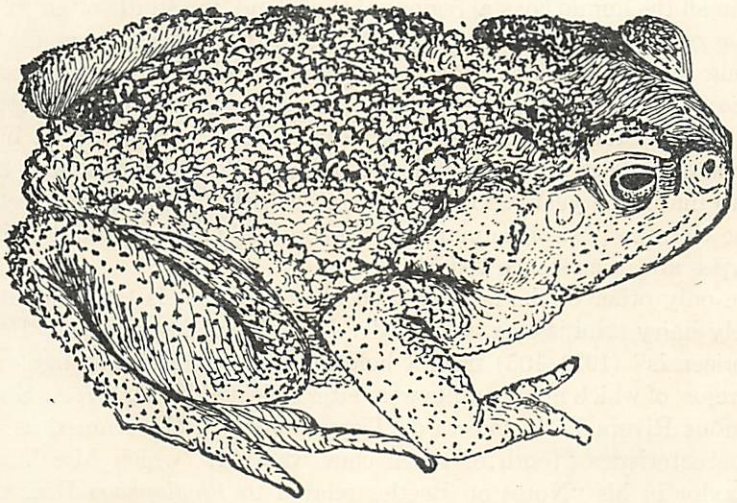
Female of the introduced Giant Surinam Toad, *Bufo marinus* (L.), less than natural size. (Drawn by G. N. Wolcott.)

Rico" (Bulletin No. 74, San Juan, March 1932) which had been investigated by Mrs. Raquel Dexter, detailed both the beneficial and the injurious aspects, the former so greatly preponderating that the entomological delegate from Hawaii, Mr. C. E. Pemberton, promptly made a shipment of them to Hawaii, and took more with him in person.

No such apparently inexhaustible food supply awaited *Bufo* in Hawaii as it had found in Puerto Rico, but otherwise the environment was suitable, and the benefits of its introduction in practically eliminating many kinds of insect pests were so apparent that introductions were made from there to Queensland, Australia, and to many of the smaller islands of the Pacific.

The story of the giant Surinam toad is incomplete without mention of the

experiences of Mr. Walter F. Jepson, whose "Report on the Search for Parasites of *Phytalus smithi* Arr., Field Investigations on Parasites of White Grubs in the United States and Puerto Rico, and their Shipment to Mauritius" (pp. 66, Port-Louis, Mauritius, 1936) gives an exceptionally good picture of the white grub situation in Puerto Rico at the time he was here. He struggled manfully to carry out his instructions to ship insect parasites of white grubs to Mauritius, but it was so obvious that effective control was primarily due to the toads, and not to insects, that in addition he took with him sixty live toads. The authorities in Mauritius, totally



Male of the introduced Giant Surinam Toad, *Bufo marinus* (L.), less than natural size. (Drawn by G. N. Wolcott.)

unprepared for such an importation, ordered the toads destroyed and years later, when finally convinced, had fresh shipments made from Puerto Rico.

Following the peak of abundance of *Bufo marinus* in Puerto Rico, when every possible source of food was devoured, and the toads spread into the less suitable environments of all but the highest mountains, the result was to reduce the common white grub population to a minimum, and apparently to exterminate at least one of the less common species. The investigations of Mr. E. Greywood Smyth on "The White-Grubs Injuring Sugar Cane in Porto Rico" (Jour. Dept. Agr. P. R. 1 (2 & 3): 47–92 & 141–169, illus. San Juan, 1917), confined to the coastal regions, indicated only four endemic species in Puerto Rico, of which the medium-sized one which he named and described as **Phyllophaga guanicana** occurred only in the Guánica region. His type material proves the former existence of this insect, but not a single individual has been collected since, altho Dr. Stuart T. Dan-

forth, the College of Agriculture at Mayagüez, always urged his students from the Yauco and Guánica regions to look for it, when they entered his classes in entomology.

Nor is this the **Lachnosterna monana** of Herr J. Moser (Stettiner Ent. Zeitung, **82**: 181. Stettin, 1921), a similar medium-sized species from the similar xerophytic environment of Mona Island, where toads do not occur, and these May beetles are correspondingly numerous even to the present time.

Somewhat larger than Smyth's *guanicana* is his **Phyllophaga citri,** abundant in all the humid coastal regions of the Island, the adults often collected feeding on the leaves of citrus trees, and, to that extent, economic pests. Judging by size alone, this may be presumed to be Moser's *Lachnosterna insulicola* ("Neue Arten der Gattunger *Lachnosterna* Hope und *Phytalus* Er. (Col.)," Stettiner Ent. Zeitung, **79:** 19–76. Stettin, 1918), but the letter and package containing all the common Puerto Rican May beetles sent to him some years ago for comparison with his types, were returned by the German post-office marked "Gestorben," and it is doubtful if even his types are in existence today.

The only other of the less common coastal species is the large and extremely hairy **crinitissima,** which Mr. J. D. More described in "Insectae Portoricensis" (1924–105) from a holotype male collected at light at Pt. Cangrejos, of which many adults were later collected by Dr. W. A. Hoffman in Muñoz Rivera Park, Puerta de Tierra. Johnny More noted as one of its characteristics "tooth of tarsal claw wanting," which Mr. Lawrence W. Saylor in his "Notes on Beetles related to *Phyllophaga* Harris, with the Descriptions of New Genera and Subgenera" (Proc. U. S. National Museum, **92** (3145): 157–161, pl. 1. Washington, D. C., 1942) used as the basis for making the new monobasic subgenus: **Abcrana.**

Intensive collecting in the higher mountains of Puerto Rico has indicated, to date, the presence at these altitudes of at least four additional species of May beetles. Presumably these mountainous species are as abundant now as when Smyth made his intensive studies of the coastal species, for the introduced toad finds these elevations too cold for its comfort, but the beetles are definitely not common. Dr. E. A. Chapin (1935–70) described **Phyllophaga yunqueana** from a holotype male collected by Dr. Leonard Stejneger in 1900, and **Phyllophaga discalis** from a holotype male intercepted by Mr. R. G. Oakley at Indiera, in the mountains above Yauco, and others in the mountains between Mayagüez and Añasco, collected by J. A. Zalduondo when he was in college.

Mr. Lawrence W. Saylor, describing "Ten New West Indian Scarab Beetles of the Genus *Phyllophaga*, with two new Names" (Washington Academy of Sciences, **30** (7): 305–314. Washington, D. C., July 15, 1940),

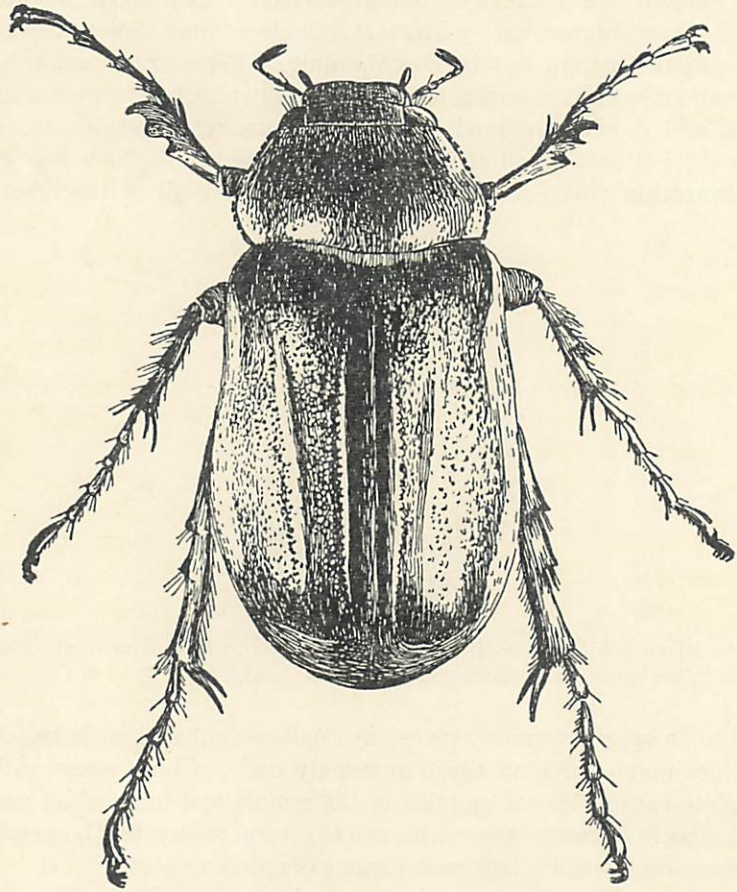
includes two from Puerto Rico: **Phyllophaga (Phyllophaga) adjuntas,** which "externally resembles *P. citri* Smyth, but differs from that species in the nonpruinose dorsal surface, the much longer male antennal club, and the quite different male sixth abdominal segment," and **Phyllophaga (Phyllophaga) wolcotti** from El Yunque, and others from Indiera in the mountains north of Yauco intercepted by Mr. R. G. Oakley, "most closely related to *P. yunqueana* Chapin, but besides the quite different male genitalia, it may be separated by the darker color, less densely punctate head, nontumid clypeus, and shorter antennal club." This completes the non-economic species of May beetles, all of which are now listed in Saylor's new genus of **Cnemarachis** (1942–159) which "includes nearly all of the described

Puerto Rican White Grub, *Phyllophaga* (or *Cnemarachis*) *portoricensis* Smyth, less than twice natural size. (Drawn by G. N. Wolcott.)

West Indian species formerly placed in *Phyllophaga,*" and is characterized by "either middle or hind tibiae or usually both, of both sexes, with an incomplete carina; lateral margins of the middle and hind tibiae usually with obviously serrate edges or with one to several moderately large spines; only rarely do the tibiae lack such carinae or spines or teeth."

The most serious insect pest in Puerto Rico, an endemic May beetle which Mr. E. G. Smyth eventually named **Phyllophaga vandinei** (after Mr. D. L. Van Dine, Entomologist of the Sugar Producers' Station), the type specimens being from Hda. Santa Rita, Guánica, has its distribution limited to the western end of the Island, "its farthest east recorded occurrence being at Manatí on the north coast and Peñuelas on the south." Its eastern analogue, the almost indistinguishable **Phyllophaga portoricensis,** occurs in the remainder of coastal Puerto Rico, and in Vieques. These are big beetles, **Cnemarachis vandinei** adults being 17.0 to 22.0 mm. long, and **Cnemarachis portoricensis** averaging 1.0 to 2.0 mm. larger.

(Judging by the size given by Herr Moser, his *Lachnosterna portoricensis* (1918–62) (= *Phyllophaga borinquensis* Blackwelder), length 21.0 mm., may be either one, as the type locality is merely "Portorico"). The morphological differences noted by Smyth are that in the male genitalia of



The Puerto Rican May Beetle or "Caculo," *Phyllophaga* (or *Cnemarachis*) *portoricensis* Smyth, about three times natural size. (Drawn by G. N. Wolcott.)

vandinei "armatures of theca (are) bicuspidate; spicula sharply deflexed," while in his *portoricensis* the "armatures (are) spatulate at tip; spicula roundly deflexed," but for practical purposes, one identifies them by their geographic distribution. Since this cuts squarely across any natural division of the Island by rainfall or soils, it appears essentially irrational. Economically they are a single species. The adults of both feed indiscriminately on the leaves of sugar-cane, and of many trees. After the first

instar, the grubs eat only live roots of plants. Destruction of the weeds in a field by cultivation forced them to feed on the roots of sugar-cane or of some other crop, and often they were so abundant as to kill the plants the roots of which they attack. Growth of the grubs is rapid, and they may attain full size inside of five months. The entire life-cycle requires but one year, as compared with two years for May beetles of southern United States, three years for many of those of the northern United States, and four years for most of those of Canada. Adults appear in greatest numbers at the time of, or before the spring rains of April, and in somewhat lesser numbers again in late August, with now and then one coming to light at any time from September to March.

Certain especially favored banana plants may be entirely stripped of their leaves by the feeding of one or the other of these species of May beetles, when they are most numerous, but on other trees, the effects of their feeding are not so noticeable. The leaves of introduced trees, like the Australian beefwood (*Casuarina equisetifolia*) and the silver oak (*Grevillea robusta*), often appear to be preferred to what, thru long establishment here, are considered native trees, or those which are really endemic. One may wonder whether the introduction of these foreign trees, plus the extensive growing of sugar-cane, which furnishes preferred food for both adults and grubs, was the lever or factor which so greatly favored these endemic beetles that they could become so abundant, before *Bufo marinus* was introduced, to readjust the balance.

By comparison with what one finds in grub-infested fields in the United States being plowed, those of Puerto Rico would appear to have none of the Scoliid cocoons of the numerous species of *Tiphia* and *Elis* or *Campsomeris*, representing possibly the major factor in the natural control of white grubs in the States. To be sure, representative species of all these Scoliids do occur in Puerto Rico, and a few, attacking other than the economic species of white grubs, are quite abundant, but they are heavily parasitized by numerous Bombyliid flies, thus the influence of the Scoliids attacking the economic species of May beetles is negligible. In all the millions of hand-picked grubs collected at Guánica while Smyth was working on the white grub problem there, not one was noted that was parasitized, nor was a cocoon ever found in the fields being plowed, even when special search was made for them after the releases of Illinois species of *Tiphia* and *Campsomeris*. Very definitely, something must have happened, of which we have no knowledge, since Dr. Gundlach reported *Tiphia argentipes* Cresson as abundant, for no entomologist has ever found it abundant since.

In studying "Porto Rican Cane-Grubs and their Natural Enemies" (Jour. Dept. Agr. P. R., 9 (4): 291–356, fig. 21, ref. 15. San Juan, October 1925), Mr. Harold E. Box was "able to demonstrate that the third instar

grubs are host of the Scoliid wasp, *Dielis* (*Campsomeris*) *trifasciata* F., and are also liable to attack by *D. dorsata* F. and *D. pyrura* Roh. The second instar grubs have been found to serve as host for another Scoliid, *Elis xanthonotus* Roh., and it is not improbable that *Lachnosterna portoricensis* is the host of *Elis ephippum* F." These last two are now considered synonymous, but Mr. Walter F. Jepson, rearing them at Cidra, found that the females also attack third instar grubs. He was able to confirm most of Mr. Box' records, and also noted that second instar grubs, in his mountain laboratory, were attacked by *Elis haemorrhoidalis* F. His rearings were made in the mountains, at Cidra, while those of Box were made at Aguirre on the south coast, two entirely different environments, altho only a few miles apart on the map. It is doubtful, however, if the attack of the very common *Campsomeris dorsata* F. and *Elis haemorrhoidalis* F. on the economic species of *Lachnosterna* is normal in the field, which leaves the much less abundant *Elis ephippum* F. (= *Elis xanthonotus* Rohwer), *Campsomeris trifasciata* F. and the rare *Campsomeris tricincta* F. (= *Dielis pyrura* Rohwer) as their only specific parasites. An abundance of hosts normally implies an abundance of parasites, but despite an enormous abundance of hosts, these Scoliid parasites have always been comparatively rare.

That white grubs never generally became as serious a pest in the more humid parts of the Island as they were on the xerophytic south coast is presumably due, in part at least, to specific parasites which were confined to the humid regions. One of these is an endemic Tachinid fly, *Cryptomeigenia aurifacies* described by Mr. W. R. Walton (Proc. Ent. Soc. Washington, **14** (4) : 198–200, illus. Washington, D. C., January 10, 1912) from Añasco, and generally present in the more humid areas in Puerto Rico. The adults attack May beetles when they raise their wings in flight, and oviposit in the soft upper side of the abdomen thus exposed. The grubs develop rapidly within the body of the beetle, and, to quote Smyth, "the number of pupae found within one dead adult host varies from two to nine, usually four to six. Infested beetles that have died are always found in their burrows in the ground."

A much less common species, with similar habits, is *Eutrixoides jonesii* Walton. Repeated attempts were made to bring puparia of these flies from Guánica's old Central Pagán property at Añasco to their Hda. Santa Rita, but the flies could not survive such an abrupt change in environment.

Of possibly even greater importance in the natural control of white grubs in the more humid and elevated parts of Puerto Rico is the endemic "cucubano," an eyed Elaterid beetle, *Pyrophorus luminosus* Illiger, the luminous subterranean larvae of which feed on white grubs. A single

larva, reared in the laboratory from egg to pupa, ate 68 white grubs, and would have killed more had they been available. The habits of the charming and innocent fruit-eating adults are in most striking contrast to the unbridled ferocity of their voracious larvae, which, after they have temporarily satisfied their appetite for food, appear to kill additional white grubs merely for the sport of killing. The number of luminous cucubanos which one might see after twilight in a dewy meadow was a very obvious visual demonstration of the number of white grubs that they must have destroyed.

Altho one would never guess from the title of Dr. Alexander Wetmore's "Birds of Porto Rico" (Bulletin No. 15, Board Comm. Agr. P. R., *and* Professional Paper, Bulletin No. 326, U. S. Dept. Agr., pp. 140, pl. 10. Washington, D. C., March 24, 1916) that it was primarily a study of the economic food habits of the native and migratory birds, with especial emphasis on white grubs or May beetles, it is in fact just one facet of the attempt to control these pests by natural means. From the standpoint of the cane growers, its conclusions were rather disappointing, for they already knew from personal observation that the boat-tailed grackle or "mozambique" (*Holoquiscalus niger brachypterus*) fed on white grubs, fearlessly following the bull-teams plowing, and picking up the grubs in the furrows just as soon as they were uncovered by the plow. Even today they follow the snorting tractors, the gyrotillers and the Fowler drag-plows, but until recently found little to reward their courage. That the bare-legged owl feeds upon May beetles or "caculos" means little to cane fields in the vegas, for the owls live mostly in the forested mountains, and possibly if someone had examined their stomach contents obtained by Dr. Wetmore and extracted the male beetle genitalia, these rarer mountainous species of *Lachnosterna* could have been described first. The little blue heron also feeds on caculos, and possibly in the more retired fields of "poyal" lands might be a minor factor in control. This completes the list of local birds having any appreciable effect on the May beetles of Puerto Rico, and Dr. Wetmore hesitated to recommend the introduction of any bird from abroad that might feed on them if it became established here.

The later study by Dr. Stuart T. Danforth of the "Birds of Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1926) showed that the least grebe and the killdeer ate beetles, and that grubs were eaten by the local thrush. Dr. Wetmore had emphasized that the cane field environment is most unfavorable for bird life, and the observations of Dr. Danforth offered little additional encouragement, even if they did enlarge the list of birds which, in their own favored environment, might slightly affect the white grub problem.

The investigation by the writer on "The Food of Porto Rican Lizards"

(Jour. Dept. Agr. P. R., 7 (4): 5–37, ref. 8. San Juan, August 1924) indicated that "the common large brown or black tree lizard, *Anolis cristatellus*, is large enough to eat such large, apparently unpalatable and hard to digest beetles as even the May beetles or "caculos." The iguana, *Ameiva exsul*, is amply large enough to eat such beetles, and does in fact eat the white grubs. The iguana is, (however,) exclusively diurnal and the large tree lizard is so largely so that neither of them has any real opportunity to catch May beetles, which are just as exclusively nocturnal."

The iguana is subterranean during most of its existence, usually appearing above ground for only a few hours in the hottest part of the day. It burrows rapidly and easily thru the ground, and eats not only the larval stages but also the eggs of May beetles. Its most serious enemy appears to be the mongoose, *Herpestes birmanicus*, introduced into Puerto Rico first in 1877 and repeatedly in later years. Dr. J. G. Myers in "A Preliminary Report on an Investigation into the Biological Control of West Indian Insect Pests" (Empire Marketing Board 42, pp. 172. London, July 1931) notes that "wherever the mongoose has become established, it tends to extirpate these lizards everywhere, save in the immediate vicinity of towns. This both Dr. Thomas Barbour, recording "Some Faunistic Changes in the Lesser Antilles" (Proc. New England Zoological Club, 11: 73–85. Cambridge, January 10, 1930), and myself have observed in a number of the islands." No other explanation of the enormous increase in the number of May beetles in Puerto Rico by the beginning of the twentieth century seems more logical than that it resulted from the wide-spread destruction by the mongoose of what formerly had been its most important natural enemy, the ground-lizard or "iguana," *Ameiva exsul* (Cope).

The prospect for control by native wild vertebrates being so discouraging, the possibility of using hogs for eating white grubs was explored. For years, Guánica Centrale had herds of hogs to compete with the grackles in picking up grubs after the plows, but when no plowing was being done, the pigs had to be fed purchased corn, which was an annoyance to cane growers, and decidedly uneconomical. Women and boys could be hired more cheaply, and millions of grubs and beetles were collected by hand each year for many years, concerning which one may consult the account by Mr. E. H. Barrow giving definite figures (Jour. Dept. Agr. P. R., 8 (2): 22–26. San Juan, April 1924), in every Hacienda on the south coast. Dynamite exploded in a grub-infested field from which the cane has just been cut makes an impressive crater, and sends earth and grubs high in the air, but when they come back to earth, the grubs seem uninjured, and unless promptly captured, soon burrow in among the clods and disappear from sight. This is only the most spectacular of the valueless attempted methods of artificial control, as recounted by Dr. Richard T. Cotton on

"Experimental Work on the Control of White Grubs in Puerto Rico" (Jour. Dept. Agr. P. R., 2 (1): 1–18. San Juan, January 1918). In later years, the use of carbon bisulfide emulsion and of ortho- and paradichlorobenzene was found successful in killing grubs, without injury to the cane plants, but the expense of the chemicals plus that of application made the cost prohibitive, and none of these methods of chemical control has ever been used on a field scale.

Within a few years after *Bufo marinus* became at all abundant, all means of chemical control became obsolete, and practical growers filled gunny sacks full of toads from localities such as lagoons, reservoirs and pools where they could be easily collected in large numbers, and released them in grub-infested cane fields, where they would be of most immediate practical benefit. A few years later, distribution of *Bufo marinus* thru its own efforts had become so uniform and universal that cane growers calmly accepted its beneficial presence as part of the normal processes of nature, tending to forget, after the disappearance of the white grub menace, how serious a threat it had once been to the agriculture of the Island.

The solution of the white grub problem by the introduction of the toad was indeed a major triumph for biological control, at least during the years when it was most effective. Its fundamental weakness was in its very effectiveness however, for despite the supposed omnivorous food habits of the toad, the major elements in Puerto Rico are May beetles and other Scarabaeids, "vaquita" leaf beetles and millipedes. When these are gone, and we have close to total control of white grubs in cane fields, there is little else for the toads to eat. Vast numbers of them must have perished of starvation. As was explained in detail in "What has happened to the giant Surinam Toad, *Bufo marinus* L., in Puerto Rico" (Revista de Agricultura y Comercio de P. R., 38 (1): 25–29, fig. 7. San Juan, January–April 1947), "scarcity of food is only one factor which increasingly tends to limit the abundance of the Surinam toad. In the West Indies at least, the weakest point in its life-history is the tadpole or pollywog stage, which must be passed in fresh water. In addition to all the large and fierce dragon fly nymphs which attack the helpless tadpoles, the even larger and more voracious larvae of the endemic Dytiscid beetle, *Megadytes gigantea* Castelnau, appear to be the deciding factor in whether any tadpoles will survive to become adults. A single one of these large beetles may lay dozens of eggs in a pool, from which emerge small worm-like larvae with enormous jaws. At first they feed on insects and very small animals, but before they are more than half-grown, they attack tadpoles almost ready to leave the water, and often are forced to complete their growth by cannibalistically feeding on each other when every tadpole in the pool has been destroyed."

Reproduction also became more difficult because after three exceptionally

dry years, Cartagena and Guánica Lagoons completely dried up, and thus disappeared the most favorable environments for the development of the tadpoles on the south coast. Rapidly the balance for the toad began to swing in the opposite direction. Cane growers of a new generation, inexperienced in the plagues of white grubs that had infested the fields of their fathers, again began to complain about the abundance of white grubs. When advised to bring toads to infested fields, the problem was where to find the toads.

The rapid increase in abundance in recent years of the common bullfrog of the southeastern United States, *Rana catesbeiana* Shaw, introduced in 1935 into Puerto Rico, at the same time that the toad was becoming so scarce, was thought to indicate a possible incompatibility between the two introduced amphibians. Their pollywogs inhabit the same pools, altho the adults occupy entirely different ecological niches. In a study of the food habits of the frog, Mr. Mario Pérez found that altho the frog may be cannibalistic in devouring its own smaller adults and larvae, it did not eat either the pollywogs or the small adults of *Bufo marinus*. The tadpoles of both feed primarily on aquatic algae, of which an amount ample to feed them rapidly grows on the stones and vegetation of every pool. There is thus no serious competition between frog and toad, either as larva or adult, for the frog adult feeds extensively on aquatic insects and other items, and but rarely on the Maybeetles that are the mainstay of the toad.

"The Rise and Fall of the White Grub in Puerto Rico" (American Naturalist, **84** (816): 181–191, ref. 19. Lancaster, Penn., May–June 1950) shows how essentially temporary was this all too effective control by a single natural factor, and re-emphasized the importance of finding a chemical means of attaining the same end which would be entirely under the control of the grower. It has been found that both aldrin (Hyman 118) and the gamma isomer of benzene hexachloride (BHC) are very toxic to even the largest grubs, as little as 2 pounds per acre of either chemical giving commercial control. In the year and a half that these chemicals have been tested, no appreciable diminution in effectiveness is noticeable, and it is possible that they will render soils to which they have been applied permanently sterile to white grubs.

Much smaller than any of the May beetles just noted, only 8.0 or 9.0 mm. long, is what Smyth described as *Phytalus insularis*, but was later identified as **Phytalus** *apicalis* Blanchard, and is now listed under Saylor's new generic name of **Clemora.** This little beetle occurs not only everywhere in coastal Puerto Rico from Faro de Cabo Rojo to Luquillo, but even in the mountains, at Aibonito, and also on St. Thomas. At Guánica, Mr. E. G. Smyth collected large numbers feeding on *Amaranthus* and Pará grass, and at Garrochales on *Lantana involucrata*, but at Pt. Cangrejos it at times almost defoliates Snow-on-the-Mountain (*Phyllanthus nivosus roseopictus*).

In a sandy field being plowed near the bridge between Palo Seco and Pt. Salinas, numerous skulls of third instar grubs on this beetle were found entangled in the outer threads of Scoliid cocoons from which adults of *Elis haemorrhoidalis* F. usually emerged, altho from some cocoons, the hyperparasite, *Anthrax gorgon* F., came out. This was the first discovery anywhere in Puerto Rico of fresh Scoliid cocoons associated with empty white grub skulls that could be identified. Subsequently, however, Mr. Harold E. Box (1925–334), finding females of this wasp very abundant in restricted localities, collected and transported them to other places where unparasitized grubs were numerous in Aguirre's cane fields. The grubs are so small that they must occur in large numbers to cause any serious damage, and are hardly of economic importance, but it was an interesting experiment, and most successful, for parasitism increased rapidly where the females had been released.

Cane growers in the British West Indies are accustomed to differentiate between the two kinds of May beetles as "brown hard-backs" for the *Lachnosterna*, and "black hard-backs" for those generally black instead of brown. The shiniest and most nearly impunctate of the black hard-backs in what Drs. Stahl and Gundlach listed under the genus *Chalepus*, and, after various changes to *Dyscinetus* and *Parachalepus*, is now called **Chalepides barbata** F. Presumably it was named *barbata*, not after Barbados, where it does not occur, but from the beard of long grey hairs at the rear end of the body projecting from under the elytra. Before the introduction of *Bufo marinus* into Puerto Rico, it was very abundant, especially in the more humid regions, and adults attracted to lights at night might often be a terrific nuisance. At a dance in the open-air pavilion of the Bayamón Saddle & Motor Club, they accumulated in such numbers on the dance floor as to stop the dance, for no sooner was the floor swept clean than additional beetles flew in to impede the progress of the dancers. The beetles are essentially harmless, and their grubs feed only on decaying vegetation in the soil, never, even accidentally, eating live roots. The first flights of adults to light in the spring usually came in mid-April, and by early in May they constituted the vast majority of all the insects coming to light. They proved to be as welcome to *Bufo marinus* for food as were the brown hard-backs, and toad excrement pellets have been noted which contained the remains of as many as 17 of these beetles. Naturally, they became scarce when the introduced toad became most abundant, and even with the present decreased numbers of toads, made but a single one-night appearance at Río Piedras in 1947, most of which was absorbed by the toads, reappearing as excrement pellets by the next morning.

On the night of September 23, 1948, when a hurricane was passing over Matanzas, Cuba, Key West, Florida and the Everglades, but when there was no rain at Río Piedras, and when there had been none in several days,

many of these beetles emerged from the ground, and were swept up from the hallways of the Experiment Station building next morning, or appeared in pellets of toad excrement. No other instance of response to barometric pressure is on record, and this may have been merely a coincidence.

Dyscinetus picipes, originally described as a *Chalepus* by Hermann C. C. Burmeister in his "Handbuch der Entomologie" (**5:** 79. Berlin, 1847) from material from Puerto Rico, is similar in general appearance to *barbata*, but is not bearded, and the elytra are distinctly striate and punctate. Not especially common, the adults have been noted feeding on the roots of sugar-cane at Carolina, of malojillo at Mayagüez, and on the corms and roots of yautia at Cayey, and would possibly be a major pest were they more numerous.

Dyscinetus morator F., repeatedly recorded from Puerto Rico as *Dyscinetus trachypygus* Burmeister, separately or in synonymy with *picipes* may be nothing more than a name, as all specimens in the collection of the Experiment Station at Río Piedras were identified by Dr. Chapin in 1932 as being *picipes*.

With stronger spines on its legs, with elytra deeply striate and punctate, not larger than the other black hard-backs, but thicker, heavier and more heavily chitinized, and with roughened areas on the abdomen by means of which it audibly makes known its objection to being held between the fingers, is what always up to now has been called *Ligyrus tumulosus* Burmeister. Or almost always, for Chevrolat's determination of Dr. Gundlach's specimens was *Ligyrus fossulatus* Latreille. The only species listed by Dr. Blackwelder (1944–254) from Puerto Rico are **Ligyrus cuniculus** F. and **Ligyrus fossor** Latreille, altho all specimens in the Station collection at Río Piedras were identified in 1932 by Dr. Chapin as **Ligyrus tumulosus** Burmeister, a species which Dr. Blackwelder restricts to continental United States, Mexico and Cuba. At the time that Mr. Eugene Graywood Smyth was commencing his white grub investigations at Hda. Santa Rita, Guánica, the larvae of *Ligyrus* were temporarily very abundant in cane fields, but it was only after extensive rearing that the essentially harmless character of their feeding was decisively proved. They eat only decaying vegetation in sandy soil: typically the dead cane stool which the larger *Lachnosterna* grubs have killed. The *Lachnosterna* grubs feeding on live cane roots have yellow heads, while those of all feeding on decaying vegetation are brown, or at least a much browner yellow. *Ligyrus* grubs also do not have the permanent quirk in their body characteristic of *Lachnosterna*, and when the sandy land in which they live has been saturated by rainfall, have been observed crawling about on its surface, their body dragging out straight behind, until the top soil has dried out sufficiently to

permit life for white grubs beneath its topmost layer. Eventually, Smyth published life-history summaries for all of these grubs, showing that *Ligyrus* can complete its entire life-cycle in less than three months. Harmless as *Ligyrus* may be in its immature stages, however, the adults sometimes bore into the base of live cane stalks, but this injury amounts to only one percent of some 50,000 stalks examined in all parts of the Island in 1921.

Before the advent of the imported toad in Puerto Rico, *Ligyrus* was often very common in most favorable environments, and they still are on Mona Island. This abundance was despite heavy parasitism of the grubs, first noted by Mr. H. Bourne at Hda. Santa Rita, Guánica on June 20, 1913. He wrote as follows:

"While I was getting these grubs, I found 28 cocoons of a wasp, very probably the black one with two reddish bands across the abdomen, *Campsomeris dorsata* F., because while digging, two flew out. This wasp is commonly seen in callejones and cane fields. I also found one grub with a medium sized larva attached to it, and one with the egg of the wasp freshly laid on its body."

Subsequently, Mr. Harold E. Box noted that this wasp "succeeds in periodically reducing the numbers of *Ligyrus* grubs in each locality almost to the zero point."

In the size of the head and in other gross characters, the fully-grown third instar grubs of *Ligyrus* are practically indistinguishable from those of the second instar of the sugar-cane rhinoceros beetle of Puerto Rico and the Virgin Islands. This is now known as **Strategus barbigerus,** described by Dr. E. A. Chapin (Jour. Washington Academy of Sciences, **22** (15): 449–456, fig. 10. Washington, D. C., September 19, 1932), but from the first record by Ledru until recently, it has been recorded under the name of *Strataegus titanus* F. *Strataegus* grubs primarily feed on rotten wood, especially the roots and stumps of trees in the soil, but when these have been consumed in recently cleared land, readily attack old cane stalks and decaying cane seed, and may eventually attack live cane root-stalks and rootlets when other more acceptable sources of organic matter are lacking. When no more new land was being brought under cultivation, reports of their injuries ceased, and the beetles are comparatively rare now as they are just small enough to be swallowed by the largest females of *Bufo marinus.* They are too large for the male toads, but the females form a ring around a beetle, and seem to dare each other swallow the hard, horny, spiny creature. After several attempts by the bravest toads to keep down such a furiously resisting mouthfull of live food, one toad accidentally swallows the beetle so that its struggles force it down into her stomach, and with her hand over her mouth, she keeps it down until all movement ceases. Only on Mona Island is the beetle at all common now, and only on Mona is

its specific Scoliid parasite, *Campsomeris atrata* F., still to be found in any abundance. From a dead beetle on Mona, the fly *Sarcophaga rapax* Walker has been reared, but it is doubtful if this is more than a scavenger.

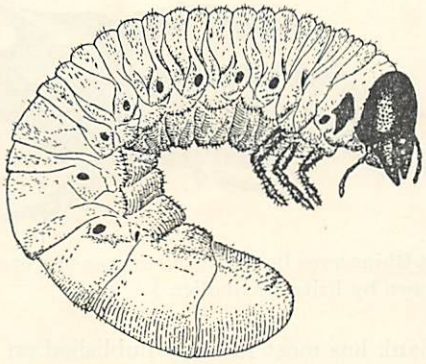
The extremely tough and heavily chitinized prothorax of the males rises in two lateral tubercles and a median anterior horn, always forked at the tip, or at least tending to be forked even when least developed. "By means of these horns the powerful male beetles can tear their way easily into mature sugarcane, and even into the solid wood of the coconut palm. The males use the horns also in fighting, and engage often in long battles. The size of the beetles, as well as of the horns, seems to be determined largely by the amount of food that was available for the larva during its period of feeding," according to Mr. E. G. Smyth, in discussing "The Rhinoceros Beetles" (Jour. Dept. Agr. P. R., **4** (2) : 3–29, illus. San Juan, April 1920). The female beetles have no horns, and indeed their prothorax is only slightly roughened anteriorly. They lay their pearly white, opaque, oblong-oval eggs singly in hardened spherical cells of earth, in which the eggs swell before hatching to be over 5.0 mm. in diameter. The beetles are often infested by mites, supposedly only catching a ride, but Smyth noted that some of these mites leave the female when she oviposits, and attain an enormously distended abdomen feeding on her eggs. The grubs, at least when reared in captivity, seem especially susceptible to the Green Muscardine fungus, *Metarrhizium anisopliae*, and also suffer from hard black spots, supposedly bacterial in origin, which gradually enlarge and may eventually cause death. The life-cycle is completed in a year.

Despite their much greater size, rhinoceros grubs seem as susceptible to the newer insecticides, such as the gamma isomer of benzene hexachloride, chlordan and Hyman 118, as are the considerably smaller ordinary white grubs. With the practical disappearance of the toad in 1948–9 in the more xerophytic parts of the Island, rhinoceros grubs began to appear in cane fields, possibly every thirtieth or fiftieth grub collected at Isabela or Aguirre being a *Strataegus*. When placed in the laboratory tests with the other grubs, and supplied with rotten wood to eat, they died at concentrations of the chemicals no greater than those killing the *Phyllophaga* grubs, but because of insufficient numbers, these data are not as extensive or conclusive as for the smaller grubs. Nevertheless, it may be presumed that few rhinoceros grubs will develop to large size in fields treated with even the minimum amount of insecticide to kill white grubs.

Apparently the toad is a much more important enemy of the rhinoceros beetle than was supposed, for not only did these beetles practically disappear when the toads were numerous, and again appear in numbers when toads were scarce, but they have continued abundant in St. Croix during all these years. St. Croix has no permanent streams or fresh water ponds,

and *Bufo marinus* can with the greatest difficulty maintain itself there, for despite its specific name, its tadpole or pollywog stage can be passed only in fresh water.

Strategus oblongus Palisot de Beauvois is at present considered the correct scientific name by Dr. Blackwelder for the coconut rhinoceros beetle of Puerto Rico, altho in all economic literature it is given as the synonymous **Strataegus quadrifoveatus** Palisot de Beauvois. Drs. Stahl and Gundlach listed it under what the latter thought "acaso nombre manuscrito": *Strataegus laevipennis* Chevrolat. It is one of the largest and certainly the heaviest beetle in Puerto Rico, with shining black, polished elytra, the male often having very well developed horns, of which the median anterior one is never forked. By means of these horns, it is able to burrow into the base of mature coconut palms, but its principal economic

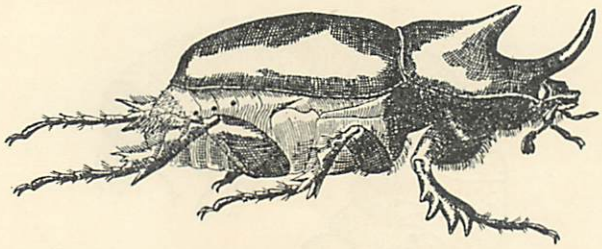


Grub of the Coconut Rhinoceros Beetle, *Strataegus quadrifoveatus* Palisot de Beauvois, natural size. (Drawn by Fritz Maximilien.)

injury is to young palms which have not yet developed a stem. Burrowing into the sand close beside such young palms, it rasps and chews into the base of the fronds, often killing the young seedling. Such injuries become abundant after hurricanes, when many such young palms are being set out in established palm groves to take the place of those which have been destroyed, and at this time also the beetles are most numerous. The eggs are laid in the rotting trunks of dead palms, on the interior of which the grubs feed, quickly causing them to collapse. The attempted use, even very temporarily, of the dead palms, for fenceposts or anything else, is not only impossible, but such dead palms are a menace in the grove, and they must be burned as soon as possible to prevent the adults from developing from the grubs feeding on their interiors. Unfortunately, few growers can be convinced of such necessity, and thus a few years after a destructive hurricane the beetles become injuriously abundant. The cost of hand-

collection of grubs and beetles, when financed by government agencies, may easily run into thousands of dollars, and becomes big business for small boys doing the collecting.

The coconut rhinoceros beetle occurs in all parts of Puerto Rico, in the mountains as well as along the coast, and the adult may attack other kinds of palm besides the coconut, and it sometimes burrows into a stool of sugar cane. The grubs are able to feed on the roots of deciduous trees, and in moist decaying tree stumps, and even in undisturbed piles of cachaza. The most exceptional host record is of a pineapple fruit at Palo Seco being tunneled into by an adult. With a stout thread tied securely around its middle, the adult beetle may serve as an exciting and somewhat dangerous pet for children, for when held suspended, it unweariedly circles like a miniature airplane, until the erosion of its bonds permits escape.



Male of the Coconut Rhinoceros Beetle, *Strataegus quadrifoveatus* Palisot de Beauvois, natural size. (Drawn by Fritz Maximilien.)

Mr. Harold K. Plank has most recently published on the "Life-History, Habits and Control of the Coconut Rhinoceros Beetle in Puerto Rico" (Bulletin No. 45, Federal Experiment Station, Mayagüez, pp. 35, fig. 12, ref. 24, Washington, D. C., November 1948), detailing the results of his investigations since 1935: a most detailed and beautifully illustrated work.

The horns of the male rhinoceros beetle are on its prothorax: those of **Homophileurus quadrituberculatus** Palisot de Beauvois are on its head, with only comparatively low tubercles on its prothorax. Dr. Gundlach first noted "la larva vivió en el nido o bulto de *Termes morio*," and all more recent collections of adults have been made in nigger-head nests of termites, one at Ciales included also "berraco" ants inhabiting part of the nest with the beetles and the termites. These are large and powerful beetles, over an inch long, and half an inch wide, with elytra deeply striate and punctate, previous identification by Dr. E. A. Schwarz as *Phileurus didymus* L. being referred to this species.

The somewhat smaller **Phileurus valgus** L. has been collected at light in Ponce, and in rotten wood at Adjuntas, Lares and Barranquitas.

Epiphileurus puertoricensis, described by Dr. E. A. Chapin (1935–69) from adults in decaying palm at Villalba, has also been found at Barranquitas.

Cyphonidae (Helodidae)

Prionoscirtes dilaticornis Champion, as identified by Mr. H. S. Barber, was intercepted on oranges trees in the mountains back of Ponce, and at Villalba, by Mr. R. G. Oakley. This is a small black beetle, originally described from St. Vincent. Numerous others of these obscure little beetles, collected on a variety of hosts and on flowers at various localities by Mr. Oakley, were identified only to a species of **Scirtes,** which is the determination given by Sir Guy A. K. Marshall to others found in the squares of cotton in a field near the beach at Laguna Tortuguero. No specific injury to the cotton could be observed at the time, and no collection has since been made on this host.

Ptilodactylidae

Ptilodactyla "perhaps **emarginata** Chevrolat" is the determination given by Mr. H. S. Barber to beetles intercepted by Mr. R. G. Oakley in the mountains of southern Puerto Rico.

Heteroceridae

Heterocerus spp., as determined by Mr. H. S. Barber, have been collected in the mud of Guánica Lagoon by Prof. J. A. Ramos.

Byrrhidae

Lioon sp., as doubtfully determined by Mr. H. S. Barber, was intercepted by Mr. R. G. Oakley on betel palm at Adjuntas.

Elmidae

The Elmids live in swiftly running water, where they cling to flat stones or aquatic vegetation. Dr. Stuart T. Danforth, making the first collections of these beetles in Puerto Rico, had **Cylloepus danforthi** named for him by Mr. P. N. Musgrave, describing "Two New Elmidae from Puerto Rico, with Description of New Genus (Coleoptera)" (Proc. Ent. Soc. Washington, **37** (2): 32–35, fig. 1. Washington, D. C., February 1935), characterized as "elongate, subparallel; dull black with dark burnt sienna tinges," the males being 1.6 mm. long and the females 1.8 mm. Later, Don Julio García-Díaz, in conducting his survey of the aquatic insects of Puerto Rico, collected not only this species, and **Neoelmis gracilis** Musgrave, which is "elongate, parallel, opaque, dark reddish-brown, length 1.4 mm.", but also **Phanocerus hubbardi** Schaeffer, originally described from Jamaica;

all three being abundant in the steam at La Mina on El Yunque, and in the Río Yúñez at Florida. **Elmis filiformis** Darlington, as doubtfully identified by Mr. H. S. Barber, was collected by Dr. W. A. Hoffman, possibly at El Semil.

Limnichidae

Eulimnichus sp., as determined by Mr. H. S. Barber, is a small aquatic beetle collected at light at Mayagüez. **Limnichoderus** sp. "near *nauicularis* Casey" was intercepted by Mr. R. G. Oakley at Ponce in water.

Melasidae (Eucnemidae)

Arrhipis lanieri Guérin-Méneville, originally described from Cuba, but listed by Fletiaux from Puerto Rico, is the only previously undescribed representative of this family not included by Mr. W. S. Fisher in his "New Eucnemid Beetles from Puerto Rico" (Jour. Agr. Univ. P. R., **19** (2): 65–66. Río Piedras, October 15, 1935). All four of these were collected by Mr. R. G. Oakley, a keen "intercepter" of previously unknown beetles, with an unerring ability to find the new and unique.

Dirhagus puertoricensis is characterized by Mr. Fisher as 2.75 mm. long, "nearly black, and in having the antennae pectinate and the elytra ornamented with two transverse, whitish pubescent fasciae," the type having been found on coffee in the mountains above Ponce.

Dirhagus oakleyi is 2.6 mm. long, has bicolored elytra, "with golden yellow pubescent fascia at apical third, the antennae flabellate," the type from pomarrosa (*Eugenia jambos*) at Aibonito.

Adelothyreus insularis is from the same host and type locality, 3.0 to 3.25 mm. long, with the "body narrow, subcylindrical, black, with an elongate, brownish yellow spot covering the exterior three-fourths of each elytron, . . . pubescence sparse, uniform, whitish."

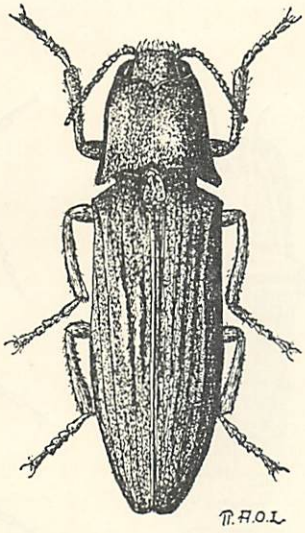
Nematodes puertoricensis is 5.0 mm. long, has a "body very narrow, subcylindrical, dark reddish-brown, . . . the elytra not distinctly striate," and was found on weeds at Matrullas Dam, near Orocovis.

Elateridae: Click Beetles

Adelocera rubida, described by Otto Schwarz ("Neue Elateriden," Stettin. Ent. Zeit., **63:** 195. Stettin, 1902) from specimens collected on Mona Island, has not been found since, so far as known.

The larvae of most Elaterid beetles are phytophagous, but those of one species endemic to Puerto Rico have long been known to be predaceous. In "The Accidental Introduction of a Beneficial Insect into Puerto Rico" (Caribbean Forester, **3** (2): 58–9, pl. 1. Río Piedras, January 1942), similar larval habits of **Chalcolepidius silbermanni** Chevrolat are first

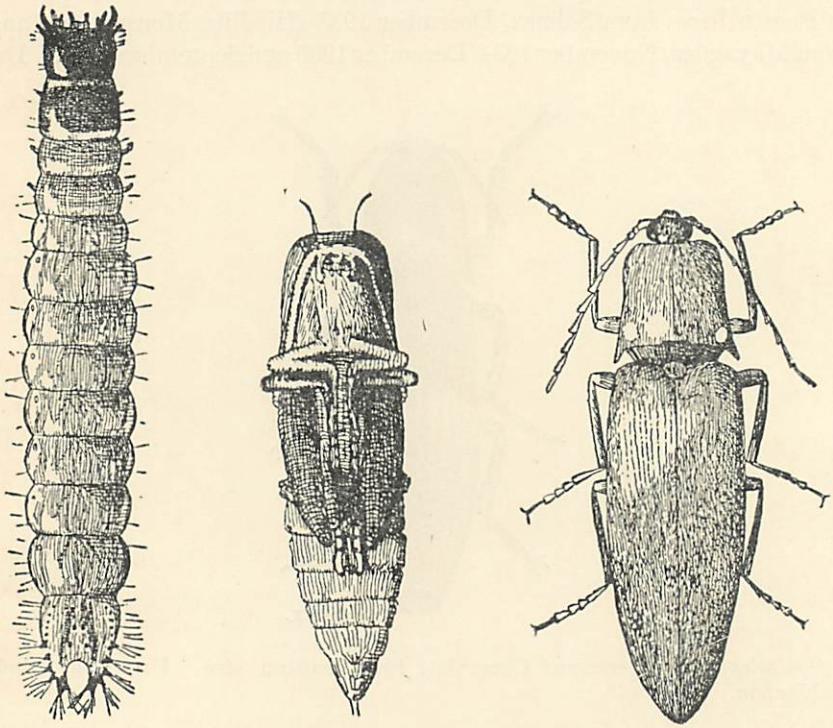
noted. This is possibly the largest and certainly the broadest of any of the click beetles to be found here, dull velvety brown or grey in color, with deeply furrowed elytra. It occurs in Mexico, Central and northern South America, Jamaica and even in St. Vincent, but had not been collected in Puerto Rico previous to 1933. It "is comparatively common in Hispaniola, where one often sees the adults sunning themselves in a sun-lit spot on the bark of a tree in a woodland glade. Some years ago, students of the late Dr. Stuart T. Danforth, at Mayagüez, began bringing in specimens collected in Puerto Rico: from Salinas, December 1933 (Hipólito Monserrate), and from Mayagüez, November 1934, December 1936 and September 1937. Dr.



Chalcolepidius silbermanni Chevrolat, twice natural size. (Drawn by Raúl Maldonado.)

Luis F. Martorell found one specimen in April 1939 at what is now Punta Borinquen Air Base, and subsequently reared one from a log of *Albizia lebeck* at Ponce infested with larvae of *Elaphidion irroratum* L. and *E. spinicorne* Drury." A log of "almácigo" (*Bursera simaruba*) from Camuy, infested with larvae and pupae of *Lagochirus araeniformis* L., was found to also contain several of these large Elaterid larvae. "Hispaniola is to the windward of Puerto Rico, both for the prevailing trade winds and for hurricanes. Unquestionably *Chalcolepidius silbermanni* was brought to Puerto Rico by commerce, for lumber, both as mahogany planks and unbarked railroad ties, has formed an important item of importations from the Dominican Republic to Puerto Rico for many years past. The un-

peeled ties are often heavily infested with Cerambycid larvae, fortunately all species already occurring in Puerto Rico, and in some of these the predaceous Elaterid larvae were also present: the predator accompanying the host insect. This appears to be one of the few instances of the accidental and quite unanticipated introduction of a beneficial insect." At no stage of its existence is any part of the body of *Chalcolepidius silbermanni* luminous.



The Cucubano, *Pyrophorus luminosus* Illiger, larva, pupa and adult, twice natural size. (Drawn by G. N. Wolcott.)

Luminosity is concentrated in two spots on the rear corners of the prothorax of the adults of the endemic "cucubano," **Pyrophorus luminosus,** described by J. C. W. Illiger ("Monogr. d. Elateren (Pyrophorus)," Mag. Gesellschaft Nat., Fr. I: 149. Berlin, 1807), and these luminous spots are sharply defined even in its pupa. The larva, however, is luminous generally in the prothorax, and slightly so on the rear edge of the following segments, but shows this luminosity only when disturbed. The cucubano larva is a subterranean wireworm, which when fully grown is nearly two

inches long, quite plump, and the color of old ivory. It feeds on other subterranean insects, more especially white grubs and "vaquita" larvae because they are normally most abundant, but has been found inside an over-ripe melon, presumably in pursuit of a melonworm, the caterpillar of *Margaronia hyalinata* L., and in a *Diatraea* tunnel at the base of a stalk of sugar-cane. Mr. Francisco Seín, Jr., reared larvae from egg to pupa in captivity, and by actual count found that a single cucubano wireworm ate sixty-eight white grubs in attaining full size, as is related in "El Cucubano, *Pyrophorus luminosus* Illiger" (Circ. No. 80, Estación Experimental Insular, pp. 5–8 fig. 3. Río Piedras, October 1923). This number does not include those killed for sport, as when it had eaten all that it could hold, it would continue to kill additional grubs merely for the joy of killing. Unquestionably the cucubano was an important factor in the control of white grubs in the more humid sections of the Island, but it rarely occurs on the xerophytic south coast where injury by white grubs was greatest.

In an effort to control the Barbadian white grub, *Phytalus smithi* Arrow, some thousands of living cucubano larvae were collected at Cidra and sent by airplane express to Barbados in 1933, and a few years later others were sent to Mauritius, where the same Barbadian white grub is an even more serious pest. Cucubano adults have been noted in the regions where these larvae were released in Barbados, and possibly the species has become established there. On the basis of what it costs to hand-pick white grubs in Barbados, as compared with how many grubs each cucubano larva destroys, it was estimated that these imported cucubano larvae were worth all they cost, even if they had all died in the first generation.

The introduction of the giant Surinam toad, *Bufo marinus* (L.), into Puerto Rico affected the cucubano in two ways: by reducing the number of white grubs available for food for the larval cucubano, and also because the luminous adult cucubano proved to be quite as acceptable to the toad for food as were the caculo adults. At the lower elevations along the north coast, *Pyrophorus luminosus* practically ceased to exist when *Bufo marinus* had reached its peak of abundance, but in the mountains where it was too cold for comfort for the toads, the cucubano remained as abundant as ever. By 1940, a few adult cucubanos might again be seen on the north coast, marking the passing of the crisis caused by the introduction of the toad.

The visiting Botanist Ledru noted the presence of the cucubano in 1780, using the name *Elater phosphoreus*, but the insect had been named before Dr. Gundlach issued his list, and was correctly noted by him. Mr. R. H. Van Zwaluwenburg was the first to record the feeding of the adults on the fruit of decaying fallen mangoes, and of the larvae on white grubs. Under normal conditions, the life-cycle of the cucubano is completed in a year,

the adults appearing in the spring, from April to June, and the first pupa by the following January.

In contrast to the activities beneficial to man of the predaceous larvae of the larger Elaterids in Puerto Rico, the phytophagous larvae of the smaller species are definitely injurious to cultivated crops, especially to young tobacco transplants. In fallow land or pastures, these slender little wireworms feed on the roots of grass or weeds, causing no appreciable injury so far as the farmer is concerned, but when a field is plowed and cleared for planting tobacco, the wireworms are deprived of their normal food for a time, until the young tobacco plants are set out. The wireworms burrow into their roots and underground stems, often killing the plants, which have not yet recovered from the shock of being transplanted. In Cuba the damage is much more severe than in Puerto Rico, altho the species concerned are the same in both islands. Field control has been obtained in Puerto Rico by burying "considerable numbers of small potatoes in the ground where damage is anticipated. The potatoes are preferred by the wireworms to tobacco plants, which thus escape injury. To be completely effective in ridding the field of wireworms, however, it is most desirable to dig up the potatoes after they have been in the tobacco field for a week or two, and destroy them together with the wireworms which they contain. This is easily accomplished if each potato is impaled on a wire which extends above the surface of the ground, and to the other end of which a bit of cloth is tied, to indicate the position of the potato" (Wolcott 1935–545).

Conoderus bifoveatus Palisot de Beauvois, in the economic literature usually called *Monocrepidius* (or mis-spelled *Monocrepidus*), is the larger of these pests, of which the adults are found in the most varied of environments. In cotton fields, they hide during the daytime in cotton squares, or in the empty cocoons of *Alabama argillacea*. One sometimes finds them under the loose bark of trees, or hiding in opaque spider-webs, behind loose sugar-cane leaf-sheaths, and very rarely attracted to light. They fall a ready prey to *Bufo marinus*, to the local iguana and lizards, and Dr. Wetmore found that they had been eaten by Latimer's vireo, the wood pewee, the yellow warbler, the yellow-shouldered blackbird, the mozambique and the ani. Presumably *Conoderus bifoveatus* is the more common species, as most individuals in collections bear this identification label, but **Conoderus lividus** DeGeer, **C. memorabilis** Candeze and **C. pinguis** Candeze have also been recorded from Puerto Rico, all superficially indistinguishable except to the specialist. **Conoderus figuralis** Candeze and **C. sericatus** Candeze, as determined by Dr. M. C. Lane, occur on Mona Island, as noted by Prof. J. A. Ramos (1937–34), but we have no records of any from Vieques or Culebra, or any of the Virgin Islands.

Mr. R. H. Van Zwaluwenburg identified as **Heteroderes amplicollis**

Gyllenhal a beetle which Mr. D. L. Van Dine sifted from earth in 1912. Mrs. Raquel Dexter found in the stomach of a toad what was identified as **Heteroderes laurenti** Guérin-Méneville: Mr. Van Zwaluwenburg also identified as **Aeolus binotatus** Candeze a beetle which Mr. Van Dine found under cane trash at Arecibo in 1911. No more recent collections have been made of any of these three.

Dr. E. A. Schwarz identified as an **Aeolus** the beetle which was described in "Insectae Portoricensis" (1923–87), and in "Insectae Borinquenses" (1936–213) named **litoris,** from a pile of coconut husks at Arecibo. It has since been found in spider-webs on beach vegetation at Pt. Cangrejos, and intercepted by Mr. R. G. Oakley on mangrove and flowers of *Randia mitis* at Ponce. It is only 3.0 mm. long.

Drasterius elegans F., in local economic literature called an *Aeolus*, is 7.0 or 8.0 mm. long, and altho a much smaller species than *Conoderus bifoveatus*, is the much more serious pest of transplant tobacco in the mountains of Puerto Rico, where its larva is called "tijerilla." It is found in all parts of Puerto Rico, on Vieques and on Mona, the adults characteristically hiding in spider-webs, in cotton squares, in plant galls (as on the leaves of "ucar," *Bucida buceras*), and even burrowing in the excrement of *Laphygma frugiperda* in young corn. Remains of the adults were found by Dr. Wetmore in the stomach of the green heron, and Mrs. Raquel Dexter found that it is eaten by *Bufo marinus*.

Dicrepidius ramicornis Palisot de Beauvois, as tentatively identified by Mr. W. S. Fisher for Dr. Luis F. Martorell, who found it on Mona Island, is almost as large as a cucubano adult, but posteriorly it is acutely tapering. Specimens have been found at Mayagüez and at Maricao. Much smaller is **Ischiodontus** sp. "probably **anceps** Candeze," as determined by Dr. P. C. Ting, collected at Villalba.

Esthesopus paedicus Candeze, as identified by R. J. M. Valentine, was collected on Mona Island (Ramos 1947–34) and at Guánica, Ponce and Mayagüez. It is only an eighth of an inch long.

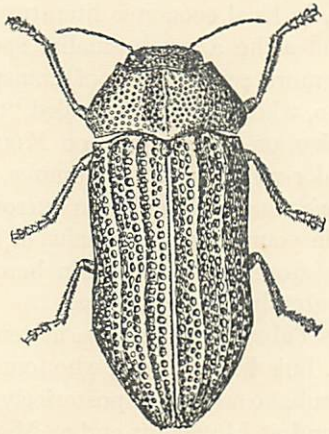
Trixagidae (Throscidae)

Drapetes chalybea was described from Puerto Rico by Carl E. A. Gerstaecker in "Die Arten der Gattung Lissomus Dalm." (Linn. Ent. Bol., **14:** 169. 1860), and Mr. R. G. Oakley found a beetle of this genus on *Mayepea* at Guánica.

Buprestidae: Flat-Headed Borers, or Metallic Wood Boring Beetles

Polycesta porcata F., the Haitian "bete d'argent," is one of the unfortunate accidental importations that have accompanied the unrestricted traffic in lumber from Hispaniola to Puerto Rico. How this could occur

is only too plainly shown by the discovery of a live larva of this Buprestid beetle burrowing out of a piece of mahogany furniture made from imported lumber. Presumably the insect is established in Puerto Rico, for adults have been collected at Salinas and Santa Isabel, in flight and resting on sugar-cane. It is the more serious pest because the larvae definitely attack trees of West Indian Mahogany (*Swietenia mahagoni*), as well as others of lesser value, feeding on the cambium when they are small, but penetrating to the heartwood as they approach full size. The adults are hardly silvery, as one might suppose from the Haitian common name, but darker and metallic greenish, or "aeneo-nigris, with a strong greenish and purplish tinge," according to Mr. W. S. Fisher in his "Revision of the West Indian



The Haitian "Bête d'Argent," *Polycesta porcata* Fabricius, twice natural size. (Drawn by Fritz Maximilien.)

Coleoptera of the Family Buprestidae" (Proc. U. S. National Museum **65** (2522): Art. 9, 1–207. Washington, D. C., 1925), who also notes: "This is one of the broadest species of the genus, averaging two and one-fifth times as long as wide." Even the smallest specimens found in Puerto Rico are three-quarters of an inch long, the largest measure all of an inch in length.

Polycesta thomae Chevrolat, black with metallic luster, was described from St. Thomas, subsequently collected by Dr. Stuart T. Danforth on Vieques, and more recently in considerable numbers on Mona Island, where Prof. J. A. Ramos found all stages in the dead branches of a beefwood (*Casuarina equisetifolia*). It does not occur in Puerto Rico. In addition to the difference in color as compared with *Polycesta porcata*, it may be distinguished, according to Mr. Fisher, because the "four costae on disc are distinctly elevated and the scutellar costae are entirely absent."

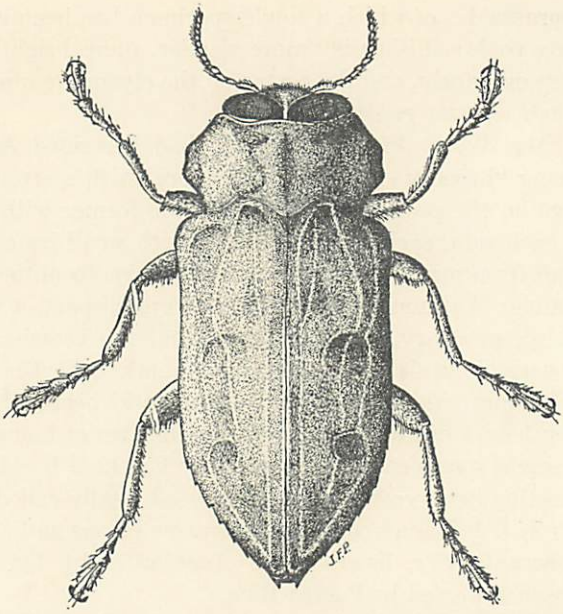
Polycesta depressa L., of which a single specimen has been collected at Ponce, according to Mr. Fisher is "more slender, more brightly colored, more acuminate posteriorly, and the costae on the elytra are more strongly elevated than in *Polycesta porcata.*"

Long before Mr. W. S. Fisher (1925–45) had described **Acmaeodera gundlachi** as being "broadly elongate, . . . aeneous, with a strong purplish or greenish tinge on the pronotum and elytra, the former with an oblong yellow spot on each side; each elytron ornated with small irregular yellow spots," the types from many coastal and mountainous localities in Puerto Rico, Dr. Alexander Wetmore had noted it as forming part of the food of the local kingbird, petchary, Latimer's vireo and the grossbeak. "This species is quite variable in size, form and elytral markings"; the type being 8.5 mm. long, 3.5 mm. wide. These little Buprestid beetles hide during the day between leaves of low weeds, or in the flowers of mangrove, ucar or sedges. A single specimen was collected by Dr. Luis F. Martorell on Mona Island, resting between the leaves of a weed locally called "té," and subsequently Prof. J. A. Ramos collected several on flowers and weeds there.

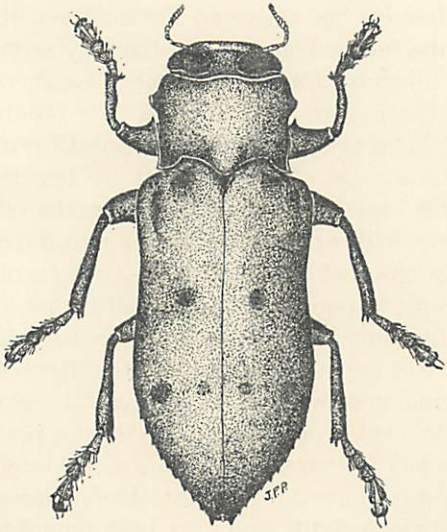
Buprestis decora Olivier, listed as an *Ancylochira* by Dr. Gundlach, has not since been collected in Puerto Rico.

Buprestis lineata F., listed by Drs. Stahl and Gundlach, is represented by one recently-collected specimen, found at Mayagüez in May 1933.

The Australian pine or beefwood tree (*Casuarina equisetifolia*) is attacked by comparatively few insects native to Puerto Rico, the endemic May beetles feeding on the foliage being almost the only serious pest. Dr. T. E. Snyder found "Injury to Casuarina Trees in southern Florida by the Mangrove Borer" (Jour. Agr. Research, **16** (6): 155–164, pl. 4, fig. 2. Washington, D. C., February 10, 1919), as he calls **Chrysobothris tranquebarica** Gmelin, to be serious. He found that the female beetle lays eggs in cracks or under the loose bark of small trees less than five years old, the larvae developing in, feeding on and burrowing into the cambium layer of the bark in all directions, and often killing the young sapling before reaching full size and ready to pupate. The normal life-cycle is completed in one year. Only a single such instance, at Vega Baja in 1930, has been noted in Puerto Rico of injury to beefwood, altho these trees and all kinds of mangrove are common everywhere in the coastal regions of the Island. This beetle is not known to occur in Cuba, altho a pest in Florida, and present in the Bahamas, Hispaniola and some of the Lesser Antilles. The adults are the largest of the genus in Puerto Rico, cupreous or aeneous in color, with deeply foveate elytra, and have been reported under a variety of names: *Chrysobothris impresa* F. by Drs. Stahl and Gundlach, *C. fraterna* described by Mannerheim, the type from Puerto Rico, and as *C. denticulata* Castelnau & Gory by Dr. Wetmore, who found it eaten by the petchary.



The Mangrove Borer, *Chrysobothris tranquebarica* Gmelin, five times natural size. (Drawn by José F. Pietri.)



The Aceitillo Borer, *Chrysobothris meqacephala* Castelnau & Gory, six times natural size. (Drawn by José F. Pietri.)

Adults are found resting on dead logs or stumps of trees, in the mountains as well as on the coast, altho presumably only small living saplings serve as food for the immature stages.

Chrysobothris megacephala Castelnau & Gory has a head which seems not exceptionally large, but certainly it is much broader between the eyes than in *C. tranquebarica*, and the smaller beetle has no such deeply sculptured foveae, thus making more prominent the "four round, deep impressions" on each elytron. It was collected on Mona Island by Prof. J. A. Ramos, and occurs in Hispaniola as well as in Puerto Rico, the observed hosts of the larvae being "gallito" (*Agati grandiflora*), reared by Mr. E. G. Smyth, and the valuable cabinet wood "aceitillo" (*Zanthoxylum flavum*), reared by Dr. Luis F. Martorell, both records from Guánica.

Chrysobothris dentipes Germar, as identified for Dr. Stuart T. Danforth (Mayagüez vi–32), may be presumed to be in error, for Mr. W. S. Fisher in his "Revision of the North American Species of the Buprestid Beetles belonging to the Tribe Chrysobothrini" (Misc. Pub. No. 470, U. S. Dept. Agr., pp. 275, fig. 126, ref. 11. Washington, D. C., September 1942) says of this species that it is "restricted to coniferous trees," of which none occurs in Puerto Rico.

Chrysobothris thoracica described by Fabricius as a *Buprestis* from St. Thomas, has subsequently been collected at Ponce and Guánica in Puerto Rico. The beetle is scarcely a fifth of an inch long, short, robust, "head bright green, with the reliefs on front cupreous; pronotum reddish-cupreous with anterior margin aureous; scutellum dark green, elytra brownish-aneous, with nile-green markings."

Chrysobothris wolcotti, described by Mr. W. S. Fisher (1925–119 to 121), the type from Mayagüez, others from Añasco and Río Piedras, was found by Dr. Stuart T. Danforth to form part of the food of the grackle and the flycatcher, and it is doubtless eaten by other birds as well. It is slightly larger than *C. thoracica*, has a similar bright green head, but each elytron is ornated with bright green markings. Dr. Gundlach referred to it as *C. lepida* C. & G., a Cuban species. Adults have been collected in all parts of Puerto Rico, and Dr. Luis F. Martorell found the larvae with characteristic flattened and enlarged thorax abundant in the trunks of the ornamental crape myrtle, *Lagerstroemia indica*.

Neotrachys hoffmani, one of the "New West Indian Buprestidae (Coleoptera)" (Proc. Ent. Soc. Washington, **32** (7): 125–129. Washington, D. C., October 1930) described by Mr. W. S. Fisher, is only 3.0 mm. long, the type from Puerto Rico, "allied to *guadeloupensis*, but differs in being subopaque, uniformly dark bronzy green above, broadly elongate and not so strongly narrowed posteriorly." Mr. R. G. Oakley subsequently found another on areca palm at Adjuntas.

Peronaemis cupricollis was described by Mr. W. S. Fisher as one of some "New Buprestid Beetles from Mexico, Central and South America, and the West Indies" (Proc. U. S. National Museum, **99** (3240): 327–351. Washington, D. C., 1949). The type was collected by Prof. J. A. Ramos at Indiera Alta, Maricao, being 11 mm. long, 3.5 mm. wide, "broadly agriliform, broadly rounded in front, strongly narrowed posteriorly, glabrous and rather strongly shining; head green, pronotum reddish cupreous, elytra olivaceous-green, body beneath uniformly bronzy green, with a distinct purplish tinge."

A single Buprestid collected at Indiera, in the mountains between Yauco and Maricao, is considered by Mr. W. S. Fisher to be possibly a new species of **Peronaemis.**

Taphocerus elegans was described by Mr. W. R. Fisher (1925–187) from a single specimen collected by Dr. Richard T. Cotton on El Yunque. Later, Mr. R. G. Oakley found another on chinaberry at Adjuntas.

Micrasta oakleyi, named after its collector by Mr. W. S. Fisher as one of "Two New Buprestid Beetles from Puerto Rico" (Proc. Ent. Soc. Washington, **37** (2): 30–32. Washington, D. C., February 1935), is from Ponce, "smaller (than *cubensis*), glabrous, and uniformly brownish cupreous, the marginal carina on each side of the pronotum entire," found on *Trophis racemosa*. What Dr. Luis F. Martorell found under castor bean leaf on Mona Island is considered by Mr. Fisher to be near this, or a new species.

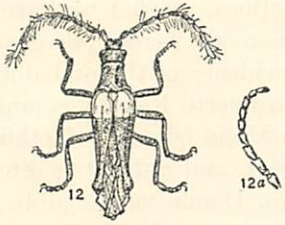
Micrasta ornata Fisher (1935–31), the type from Guánica, has "elytra ornamented with violaceous black spots, the marginal carina on each side of the pronotum obliterated anteriorly, and the elytra depressed deeply along the base." No collection has been made since that of the type by Mr. R. G. Oakley.

Micrasta puertoricensis was described by Mr. W. S. Fisher (Psyche **46** (4): 163–4. Cambridge, December 1939) from a single specimen collected by Dr. P. J. Darlington in the Maricao Forest at an elevation of 3,000 feet. Like others of the genus, it is very small, only 1.25 mm. long and 0.6 mm. wide, and "resembles *Micrasta oakleyi*, but differs in being uniformly black, with indistinct bronzy-green tinge."

Lycidae: Net-Winged Beetles

"The Lycidae, Lampyridae and Cantharidae (Telephoridae) of the West Indies" are comparatively well known because of this publication (Bulletin American Museum of Natural History, **46** (8): 413–499, fig. 65. New York, August 24, 1922) by Dr. Charles W. Leng and Mr. Andrew J. Mutchler, and their subsequent papers. They established the tribe Leptolycini and the included genus for the little black beetle, only 3.0 mm. long, with basal fifth of elytra yellow, named **Leptolycus heterocornis,**

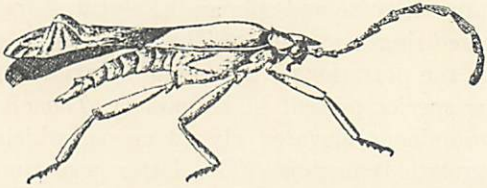
from Aibonito and Cayey. It has since been found at Villalba and Prof. J. A. Ramos has specimens from Maricao, Consumo and the mountains back of Mayagüez, all localities in the mountainous interior of Puerto Rico. Of the holotypic female with the color of the thorax and scutellum yellow, from Aibonito, to which Leng & Mutchler gave the varietal name **flavicollis,** Prof. Ramos also has specimens from the type locality.



Leptolycus heterocornis Leng & Mutchler, male, eight times natural size. 12*a* antenna of female. (After Leng & Mutchler.)

Lycids of the genus *Thonalmus* "are all elongate, glabrous insects, with long, feebly serrate antennae and subparallel elytra, usually bearing three more or less elevated ridges or costae. The elytra are of a brilliant orange or red color, with the posterior portion metallic green or violet." Of the two red and blue species present in Hispaniola, *Thonalmus dominicensis* Chevrolat has prominent elevated elytral crests, which are lacking in **Thonalmus chevrolati** Bourgeois. The latter was noted by Leng & Mutchler (1922–422) as present "in Porto Rico by commercial introduction only—at Guanica, April in boat-load of cane from Higuera (R. H. Van Zwaluwenburg)," but when questioned many years later, he could not remember whether his specimens were collected near the pier at Guánica where the cane boats from Santo Domingo landed, or dead in the hold of the boat after its load of cane fumigated with sulfur had been transferred to the empty waiting cane cars. Dr. Gundlach has no record of this strikingly obvious insect from Puerto Rico altho Dr. Stahl, possibly in error, records it as *Calopteron suave* J. Duval. The first authentic collections of live beetles in Puerto Rico were made by Mr. Felipe Mora at Hormigueros, August 1, 1932, reported but incorrectly identified by Dr. Stuart T. Danforth as *Thonalmus dominicensis.* In September 1936, adults were found in abundance in one field of young plant cane at Hda. María Antonia at Guánica, and in succeeding years others were found in cane fields as far east as Ponce by 1941. "In March 1940, a single beetle was collected at Hda. Victoria, between Coloso and Aguadilla, and several were noted in the same or adjacent fields in April and July," as reported in "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields"

(Jour. Agr. Univ. P. R., 27 (2): 85–104, fig. 12, ref. 16. Río Piedras, June 1944). In December 1939, a single specimen was found at Isabela, and in December 1943 one was collected in the mountains at Lares. Establishment in Puerto Rico had unquestionably occurred long before, presumably before 1930. If the beetle had come in on boat-loads of cane from Santo Domingo, as is most probable, it must have arrived before 1930, for it was in this year that the importation of cane ceased, due to federal quarantine restrictions. "That we have not found this beetle on Mona Island may be due to the xerophytic character of the Island, or it may furnish additional evidence of the probability of the introduction of *Thonalmus chevrolati* into Puerto Rico by commerce, for there is little or none from Hispaniola to Mona Island." Nothing is known as to the immature stages of the insect, and altho it is often noted in cane fields at La Romana and Higuera, Dominican Republic, we do not know if it in any way depends on sugar-cane. In captivity, the adults do not eat the eggs of *Diatraea saccharalis* F., and Mr. H. S. Barber is of the opinion that neither larva nor adult is predaceous.



The Lycid Beetle, *Thonalmus dominicensis* Chevrolat, four times natural size. (Drawn by Fritz Maximilien.)

Lampyridae: Firefly Beetles

Nearly a dozen fireflies are recorded from Puerto Rico, of which half are quite common, especially in citrus and coffee groves, and in virgin forest at the higher elevations, but some occur abundantly in even the most xerophytic coastal regions.

Lucidota marginipennis, described by Leng & Mutchler (1922–438) from Aibonito, has not since been collected.

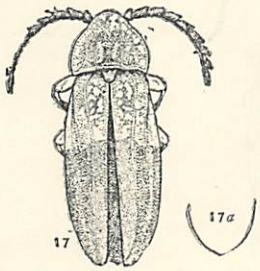
The elongate **Callopisma borencona** Leng & Mutchler (1922–440), "yellow, with apical two-thirds of elytra, tibiae and antennae black," is comparatively common. It has been repeatedly collected in grapefruit groves along the north coast, in coffee groves in the mountains and on the tree ferns of El Yunque and found to be an item in the food of lizards of these environments.

The broadly oval **Callopisma emarginata** Leng & Mutchler (1922–443), described from specimens collected at Mayagüez and in the mountains of

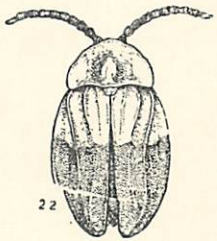
the western part of the Island, "reddish yellow, apical half of elytra, antennae and tibiae black," has since been found as far east as Rio Piedras.

Callopisma miniatocollis Chevrolat is listed from Puerto Rico by Dr. R. E. Blackwelder (1945–355), as is also **Callopisma rufa** Olivier, in synonymy with the *Lychnuris dimidiatipennis* J. Duval. The latter name was listed by Dr. Stahl, and as a *Callopisma* by E. Olivier in his "Contribution a la Faune Entomologique des Antilles Lampyrides" (Rev. Sci. du Bourbonnais et du centre de la France, **25**: 19. 1912).

Lecontea galeata, described from St. Thomas and Puerto Rico by E. Olivier (Bul. Soc. Zool. France, **24**: 91. Paris, 1899), was reported from Vieques by Leng & Mutchler (1922–453), and is found in all parts of Puerto Rico, even the dryest, as well as in the mountains. It is possibly the largest firefly in Puerto Rico, dark grey to black above, prothorax broadly and elytra narrowly margined with yellow. Mr. August Busck collected



Callopisma borencona L. & M. (After Leng & Mutchler.)



Callopisma emarginata L. & M. (After Leng & Mutchler.)

it at Fajardo, Arroyo and Aguadilla, and he is responsible for the collection on Vieques Island.

What Motschulsky described from Puerto Rico (1853–42) under the name of *Rabopus roseicollis*, "thorax red at middle; yellowish at margin, without spots; head, base of antennae, and the palpi, legs and the whole border of the elytra yellowish white," re-described by Leng & Mutchler (1922–436) as *Lucidota decorus* (Gemminger & Harold), being thus placed because the antennae are strongly serrate, is now listed as **Photinus decorus** Motschulsky. Mr. August Busck collected this at Bayamón, and it has since been found in grapefruit groves at Vega Alta and Río Piedras, but it is more typically a mountain species: from El Duque at Naguabo, and Jájome Alto, and in the higher coffee groves, being so abundant as to form an appreciable item in the food of *Anolis evermanni* and *Anolis cristatellus*.

Photinus dubiosus, described by Leng & Mutchler (1922–461) as known only from Puerto Rico, is considerably larger, 9.0 to 10.0 mm. long, "oblong,

greenish, becoming pale testaceous in drying," resembling *Photinus glaucus* of Cuba and Hispaniola, but "much darker in color beneath." Indeed, it was under the name of *Photinus glaucus* that Dr. Alex. Wetmore recorded finding this firefly eaten by the yellow warbler, the yellow-shouldered blackbird and the oriole. It is also eaten by the lizards *Anolis evermanni* and *Anolis krugii*. It has been found in the most xerophytic parts of Puerto Rico: on cotton plants at Boquerón and at light at Hda. Santa Rita, Guánica, as well as in coffee and orange groves and virgin forest in the mountains.

Photinus heterodoxus, described by Leng & Mutchler (1922–457) from females from Farjardo and Adjuntas as "elongate, 12.0 mm. long, parallel; yellowish above and beneath, the eyes only black," has not since been found.

Photinus triangularis E. Oliver. (After Leng & Mutchler.)

The type of **Photinus triangularis** E. Olivier (Ann. Soc. Ent. Belgique, **56**: 25. Bruxells, 1912) is from El Yunque, and other specimens of this large, dull yellowish or golden-brown firefly, 13.0 mm. long, have been collected there. Mr. H. S. Barber, in a note accompanying the identification of the latest collection (November 30, 1944) states that "this does not belong to the genus *Photinus*, but in the genus *Diphotus* as now understood." Mr. August Busck collected this beetle on Culebra Island, altho the highest elevation there, Mt. Resaca, is only 650 feet high, and in recent years it has been covered with sugar-cane almost to the top.

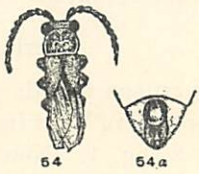
Photinus vittatus G. A. Olivier is possibly the most abundant of all the fireflies in Puerto Rico, only 7.0 mm. long, "narrow, subparallel in form; pronotum yellow with carmine disc, elytra brown with narrow subsutural vitta often joining the broader outer testaceous margin." Certainly it is more common at the lower elevations, coming to light at all times of the year at Río Piedras and Guánica. Dr. Wetmore found it eaten by the cliff swallow, the petchary, the vireo and several warblers, while the crested

lizard, *Anolis cristatellus*, also succeeds in finding it, despite its normally nocturnal habits.

Cantharidae (Telephoridae): Leather-Winged Beetles

Tylocerus barberi, dedicated by Leng & Mutchler (1922–497) "to our friends and colleagues, Herbert S. Barber of Washington and Harry G. Barber of New York," is an elongate, yellowish-brown beetle, 7.5 to 9.5 mm. long, the pronotum yellow and subquadrate, the elytra blackish-brown, margined with yellow, and with two narrow yellow stripes. The type is from Manatí, but it is common everywhere in coastal Puerto Rico, and in the mountains as at Cayey, Aibonito and Villalba, being most often attracted to light. Prof. J. A. Ramos collected one specimen at light on Mona Island. The greatest number of these beetles observed was on watershoots of an unidentified tree at Barceloneta, June 8, 1916, many being in coitu.

Tytthonyx cavicornis L. & M. (After Leng & Mutchler.)



Tytthonyx discolor L. & M. (After Leng & Mutchler.)

Tylocerus bilineatus was described by Maurice Pic in his "Neue Malacodermen" (Zool. Anz., **76** (3/6): 95–98. Hamburg, 1928) from Puerto Rico.

Tytthonyx discolor, described by Leng & Mutchler (1922–490), the type from Aibonito, others from Desecheo Island collected by Dr. Frank E. Lutz, is a little elongate black beetle with elytra only partly covering the abdomen. The type is 3.25 mm. long, but those from Desecheo are smaller, 2.5 to 2.75 mm. in length, and paler thruout, being "dark brown rather than black." Subsequent collections have been made from Lares and Camuy.

Tytthonyx cavicornis, described by Leng & Mutchler (1922–489) from an elongate brownish holotype from Mona Island, 3.0 mm. long, has since been collected there in April and June by Prof. J. A. Ramos (1947–33), "swept from shrubs on the plateau."

Mr. Howard E. Hinton described "A New Species of West Indian **Tytthonyx** (Col. Cantharidae)" (Pan-Pacific Ent., **10** (1): 30–32. San

Francisco, 1934) from Puerto Rico under the name **bicolor**, and included a key for the separation of the five known West Indian species. Three additional species, "mostly red or yellowish red in color, with the black underwings protruding from beneath the short elytra," have since been found in Cuba (American Museum Novitates No. 924, pp. 5, fig. 5. New York, May 4, 1937).

Dasytidae (Melyridae): Soft-Winged Flower Beetles

Mr. G. E. Bryant determined two small flea-beetle-like insects collected at Pt. Cangrejos on cotton bolls to be a species of *Alymeris*, now called **Melyrodes**. Prof. J. A. Ramos (1947–33) reports collecting one such, as determined by Mr. H. S. Barber, on the beach of Mona Island, at Sardinera.

Mr. H. S. Barber gives the names of **Attalus** spp., or **Anthocomus** spp., to similar small beetles intercepted by Mr. R. G. Oakley on banana leaves in the mountains back of Ponce, and on the flowers of *Inga laurina* at Indiera in the mountains back of Yauco.

Cleridae: Checkered Beetles

Callotillus crusoe was the name given by Mr. A. B. Wolcott to one of "Two New species of West Indian Cleridae" (American Museum Novitates No. 59, pp. 3, fig. 1. New York, February 14, 1923), a slender black beetle, the apical half of its elytra pale yellow, collected on the ground at Camuy. The specific name was chosen, not because Robinson Crusoe had anything to do with Puerto Rico, but as this was the only Clerid at that time known here, and that but a single specimen, it seemed as lonesome as Crusoe on his tropical island. Dr. Gundlach, however, had reported **Opilo unifasciatus** as determined by Chevrolat. More recently Mr. R. G. Oakley has collected what Dr. E. A. Chapin identified as species of **Epiphloeus** on flowers at Ponce, and of **Phyllobaenus** at Guánica. Under the bark of a dead flamboyán (*Delonix regia*), another Clerid with a transverse yellow stripe across the dark brown elytra has been found at Río Piedras.

Indeed, more intensive collecting would doubtless produce more than a month of Fridays, even if not including the abundant **Necrobia rufipes** DeGeer. This is a not-so-slender but typically hairy, bright, iridescent blue beetle, collected at Mayagüez in December 1939 by Mr. H. Ayguabibas on dried meat. Even earlier than this it had been found resting on cucumbers at Loíza, and Prof. J. A. Ramos (1947–33) on Mona Island collected "numerous specimens on decaying fish at Sardinera Beach, March 6, 1944, and others on a dead goat on the plateau, April 7, 1944."

The cosmopolitan **Necrobia ruficollis** F., greenish-blue with basal fourth

of elytra and legs red, has been found at Mayagüez in abundance by Prof. J. A. Ramos on old cheese imported from Argentina.

Temnochilidae (Ostomidae, Trogositidae, Ostomatidae)

Temnochila portoricensis, described by A. Leveille (Ann. Ent. Soc. France, **76:** 401. Paris, 1907), and **Temnochila aenea** Olivier are sufficiently abundant in forests, even if not in collections, to furnish food for the woodpecker, as reported by Dr. Alex. Wetmore.

Mr. W. S. Fisher determined as a species of **Airora** the Ostomid beetles which Mr. R. G. Oakley found under the bark of a dead tree at Guánica.

Tenebroides transversicollis J. DuVal, listed by Dr. Gundlach as a *Trogosita*, has since been collected under bark of *Inga vera* at Cayey, and with no host records, at Barranquitas, Hatillo, Mayagüez and San Germán.

Tenebroides punctulata Chevrolat, listed from Puerto Rico by Herr Edmond Reitter in his "Die Sud- und Mittel-Americanischen Arten der Gattung *Tenebroides* Piller & Mitterpacher" (Verh. Nat. Ver. Brünn für 1874, **13:** 74. 1875), is in confirmation of its listing as a *Trogosita* by Dr. Stahl. It was of this or the preceding species of which Dr. Donald De Leon found larvae and pupae under the bark of various trees at various localities, and the remains of adults of which Dr. Alex. Wetmore had reported eaten by the woodpecker and the tody.

Quite different in habits is the "cadelle," **Tenebroides mauritanica** L., a cosmopolitan pest of stored products, observed in Puerto Rico with the larvae feeding on rice and sunflower seeds. Adults have been collected at light on Mona Island, at Camp Kofresí, but it remains to be seen if the species can continue to exist there when Mona is no longer inhabited by man. It is possibly the largest beetle which feeds on stored products, being three-eighths of an inch long, shining, dark brown and quite flattened.

Dermestidae: Larder Beetles

Only by the most unremitting care are collections of insects and natural history specimens preserved from the attack of Dermestid beetles, especially in the tropics. Thus it is but natural that Drs. Stahl and Gundlach should list **Dermestes carnivora** F., and *Dermestes vulpinus* F., now called **Dermestes maculata** DeGeer, altho neither has since been found in any great abundance: the former at Lares, the latter on the docks at San Juan. **Dermestes ater** DeGeer, originally identified from Puerto Rico as *Dermestes cadaverinus* F. by Dr. E. A. Schwarz, appears to be much more common recently, with many records from all parts of the Island, those from Mayagüez being on sausage and preserved meat.

Dermestes canina Germar, as determined by Mr. H. S. Barber, was

found on Mona Island by Dr. Luis F. Martorell: larvae, pupae and adults being present in abundance on goat skins being dried and also feeding on the fragments of flesh inside turtle shells on the beach. Prof. J. A. Ramos (1947–35) found them on dead fish at Sardinera Beach.

Attagenus piceus Olivier, the cosmopolitan "black carpet beetle," elsewhere known as a common museum and household pest, in Puerto Rico was first found on cotton plants at Quebradillas, as determined by Dr. E. A. Schwarz, and Prof. J. A. Ramos has since collected these small black beetles at Isabela and Mayagüez. Numerous interceptions of undetermined species of this genus were made at San Juan.

Attagenus gloriosae F., as identified by Mr. H. S. Barber, has been collected by Prof. J. A. Ramos at Río Piedras, Ponce and Mayagüez.

Globicornis fulvipes Guérin-Méneville, listed by Drs. Stahl and Gundlach as a *Trogoderma*, has been repeatedly collected since, most recently feeding on dead butterflies. They also list **Trogoderma insularis** Chevrolat, which has since been collected in the field, at Loiza and at Bayamón.

Eucnocerus anthrenoides Sharp, as identified by Mr. H. S. Barber, has recently attacked the insect collection of the College of Agriculture at Mayagüez.

One or more species of **Cryptorhopalum** were found by Dr. Alex. Wetmore to have been eaten by warblers, and numerous subsequent collections, identified only to "sp." or "sp. nov." have since been made from the flowers of various trees: guácima, capá prieto and guamá, as well as from jasmin and sedges.

Bostrychidae: Powder-Post Beetles

"**Rhizopertha dominica** F. as a Library Pest" by Dr. W. A. Hoffman (Jour Ec. Ent., 26 (1): 293–4. Geneva, February 1933) appears to be the first record of these little yellowish-brown powder-post beetles attacking the inner portion of the back of books, altho they have since been intercepted in chicory beans and in dry chick peas at San Juan. Under the name of *Rhizopertha pusilla* F., Leng & Mutchler record the same insect as a "cosmopolitan species, or introduced from the United States in timber." It is by no means the only beetle or other insect pest which attacks books in the tropics, but the effectiveness of fumigating with cyanide at the rate of 10 pounds of Cyanogas to 10,000 cubic feet, recommended by Dr. Hoffman for the library of the School of Tropical Medicine, will doubtless be equally successful if used elsewhere against this or any other of the insects attacking books.

Dinoderus minutus F., a short little cylindrical, yellowish Bostrychid beetle, has been found in great abundance in flour, and feeding on sweet

corn seed, as well as in the trunks of upright dead trees and in the stems of dead gandul bushes. These are comparatively incidental and accidental deviations, however, from its normal habit of attacking bamboo when dry, and most injuriously when the bamboo has been made up into furniture or novelties for tourists. As such it has received the almost undivided attention of Mr. H. K. Plank for a considerable number of years, the results of his investigations being summarized in the annual reports of the Mayagüez Station from 1936 to date. The common *Bambusa vulgaris* is much more susceptible to attack than some other relatively resistant or nearly immune species, as is shown in "The Relation between Curing and Durability of *Bambusa tuldoides*" (Caribbean Forester, **7** (3): 253–273. Río Piedras, July 1946), by David G. White, Milton Cobin and Pedro Seguinot Robles. Indeed it has not been possible for Mr. Plank to secure complete immunity of *vulgaris* until he tried "DDT for Powder-Post Beetle Control in Bamboo" (Science, **106** (2753): 317. Baltimore, October 3, 1947), of which "one thorough brushing with a kerosene solution at the 5 percent residual strength resulted in 94 percent control." His studies on the "Biology of the Bamboo Powder-Post Beetle in Puerto Rico" (Bulletin No. 44, Federal Expt. Station, Mayagüez, pp. 29, fig. 19, ref. 13. Washington, D. C., May 1948) showed that "development from deposition of the egg to emergence of the adult averaged 51 days."

Heterarthron gonagrum F., a much larger, darker and more elongate Bostrychid beetle, three-eighths of an inch long, is present in all the Greater Antilles and in most of the Lesser Antilles as far south as St. Vincent. All the local records are from the more xerophytic part of the Island: Mr. E. G. Smyth having reared it from mesquite or "bayahonda" (*Neltuma* or *Prosopis juliflora*) at Guánica, Dr. Luis F. Martorell from "burro" (*Capparis flexuosa*) at Santa Isabel, and Prof. J. A. Ramos (1947–40) on Mona Island "boring in casuarinas."

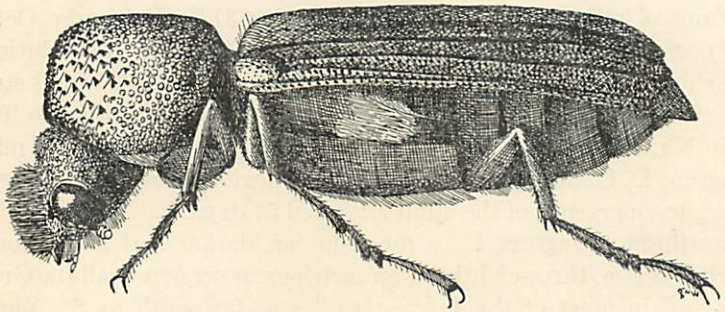
Xylomeira torquata F., quarter of an inch long, has a similar distribution, Dr. Luis F. Martorell having collected many specimens at light on Mona. Dr. Stuart T. Danforth reared it from a dead tamarind tree near Ponce, and it has been found infesting the dead branch of an unidentified leguminous tree at Coamo.

Tetrapriocera longicornis Olivier (= *T. tridens* F.), listed by Dr. Gundlach as a *Xylopertha*, with continental as well as West Indian distribution, but restricted to a xerophytic environment, was noted in great abundance at light at Guánica by Mr. E. G. Smyth in October 1913, and Prof. J. A. Ramos found a single specimen attracted to light on Mona Island in April 1944. The crested lizard, *Anolis cristatellus*, at Boquerón was found to have eaten these beetles.

Xylobiops floridanum Horn, as determined by Mr. W. S. Fisher, was reared by Dr. Luis F. Martorell from a dead branch of "burro" (*Capparis flexuosa*) at Santa Isabel.

Xylobiops parilis Lesne, previously known from Mexico, has been collected at Tallaboa, Puerto Rico, according to Prof. J. A. Ramos.

From their lateral appearance of perpetually bowed head, suggesting the devotion of priests, Fabricius gave the names of religious orders to what he considered the various species of *Apate*, but his *francisca* and *carmelita* are now thought to be only synonyms of **Apate monacha**, present in Africa as well as in the West Indies. These are large beetles, five-eighths of an inch long and three-sixteenths wide, cylindrical, dark brown and heavily chitinized, rarely coming to light, but most often found in the dead or dying trunk of a small tree in which each beetle has made a separate tunnel.



The Bostrychid Beetle, *Apate monacha* Fabricius, five times natural size. (Drawn by G. N. Wolcott.)

It "starts obliquely from a node in the tree where the small branches come out, but curves upward when the center of the slender tree is reached, and is discontinued just before joining the next tunnel. Alternate tunnel entrances are on opposite sides of the sapling, indicating that the beetles are possibly less social in their habits than might at first appear." "The female beetle lays her eggs in the tunnel of the tree which she and her companions have killed, as the larvae require the wood of freshly killed trees for their nourishment." Infestations most often develop in coffee groves, or plantations of mahogany, where the brush and small trees, cut down where the more valuable trees are to be planted, has been left lying about to furnish food for the initial generation of *Apate*. The beetles developing from this valueless brush, which should have been burned if no other use could have been found for it, then attack the economic trees and may cause serious losses before the death of the smaller trees indicates what is happen-

ing. If the infested trees already dead are of no particular value, the simplest method of killing the beetles is to cut down the trees and burn them. If the trees are alive and valuable, the beetles may be killed in their tunnels by means of a No. 6 or No. 8 soldering wire. These wires are strong enough to pierce the beetles, yet sufficiently flexible to bend according to the curve of the tunnels. Their use is entirely practical, as has been proved by extensive use.

Under the name *Apate carmelita* F., both Dr. Stahl and Dr. Gundlach recorded the presence of this pest, the latter adding, "Es dañino a los árboles, perforando la larva, los troncos y ramas." Mr. R. H. Van Zwaluwenburg thought the insect exceptionally injurious around Mayagüez in the year 1915, and it is true that most records of injury are from the Mayagüez region or the western part of the Island, the farthest east being at Bayamón in 1923 and at Río Piedras in 1912. He recorded it as attacking mahogany, coffee, grapefruit, citron, pomelo, gandul, flamboyán, willow and hueso (which may have been *Linociera* (or *Mayepea*) *domingensis*, or *Picramnia pentandra*). Additional recorded hosts are tamarind, quenepa, guava, aguacate, pomarrosa, achiote, mangle, ucar, beefwood and cultivated grape vines. Mr. H. Bourne, of Guánica Centrale, found a cane stalk at Limón infested with thirty beetles, but attack on sugar-cane is very exceptional. Even such short-lived plants as Sea Island cotton may be attacked, and sometimes the diameter of the infested sapling tree is so small that most of its woody interior is eaten away to make a tunnel large enough to contain the beetle. Rarely can such plants recover, but if the beetles have been killed, larger trees eventually outgrow the injury.

Lyctidae: Powder-Post Beetles

The Lyctid powder-post beetles are small, elongate and slender, somewhat flattened as compared with the cylindrical Bostrichids, larger and more impressive, but they are possibly even more destructive, and convert an even larger part of their host to powder.

Lyctus aequalis Wollaston, as identified by Mr. W. S. Fisher, has been intercepted at light in San Juan.

Lyctus caribeanus Lesne has been reported as attacking stored bamboo at Mayagüez, and as infesting almácigo logs at Guayama.

Lyctoxylon japonum Reitter is an oriental species, identified in 1921 by Dr. E. A. Schwarz from Puerto Rico, where large numbers were attracted to light at Río Piedras, having come from native baskets that were eventually so completely destroyed that nothing remained of them but a mere shell, and a large heap of fine yellow powder. They were parasitized by Pteromalid wasps, identified by Mr. S. A. Rohwer as a species of *Neo-*

catolaccus, and possibly for this reason the beetle has not been noted generally as a serious pest since. Indeed, the only other local record is of occurrence in the branch of a leguminous tree at Coamo, two years later.

Trogoxylon curtulum Casey, as identified by Mr. W. S. Fisher, also attacks native baskets, and has been reared from almácigo logs, but is of greatest importance as a pest of the sapwood of mahogany, *Swietenia mahagoni*. When an attempt is made to cover up the deception of incorporating sapwood in furniture supposed to be all heartwood, by heavy staining with potassium bichromate, the emerging beetles come out through both stain and varnish, leaving telltale holes and little piles of very fine powder. Very definitely, they do not breed in mahogany heartwood, and if the furniture is guaranteed to be entirely and exclusively of heartwood, their emergence will prove the sustitution of sapwood.

Ptinidae: Spider Beetles

Dr. Alexander Wetmore reported the remains of a species of **Ptinus** as eaten by the northern parula warbler, but this is the only record of a representative of this family from Puerto Rico.

Anobiidae: Drug Store Beetles

Stegobium panicea L., the tropicosmopolitan "drug store beetle," has been collected at light at Mayagüez. This is the only familiar Anobiid which Mr. W. S. Fisher identified from Puerto Rico out of the abundance of material collected here by Mr. R. G. Oakley, which was found to consist of eight new species. His descriptions of these eight new species were published in "Insectae Borinquenses" (1936–238 to 242).

Trichodesma oakeyi Fisher (1936–238) is a "very robust, brownish black, moderately shining Anobiid, "the whitish pubescence on each elytron forming a more or less distinct spot at middle and a smaller spot along sutural margin near apex." It is 5.5 mm. long, 3.0 mm. wide, the type from Aibonito. Dr. Donald De Leon, while conducting his two months survey of the forest insects of Puerto Rico, found this or other species of *Trichodesma* under the bark of mahogany and ucar at Guánica.

Lasioderma serricornis F., "la Carcoma del Tabaco," a cosmopolitan pest of stored tobacco, was first definitely identified locally by Mr. D. L. Van Dine in 1921, when found attacking the binding of books. It seems to be especially attracted to the kind of stiff cardboard used for the binding of books, or for luggage in imitation of leather, and has also been collected in Puerto Rico in packaged chocolate, in ginger, and in pepper. Stored garden seeds are often found infested, possibly the most interesting example of attack on seeds being on camándula beads, the hard grey seeds of *Coix lachryma-jobi*. Not only did the adults and developing larvae eat the

interior of these seeds, but when strung on a thread to form a portiere, the thread was so often severed as to greatly discourage the person industriously engaged in re-stringing them. Cotton seed and cotton seed meal are notoriously subject to attack, as is also tobacco seed, but the principal economic host is stored tobacco.

In the older economic literature, *Lasioderma serricorne* is called the "cigarette beetle," altho as a matter of fact one rarely finds cigarettes attacked, the injury to cigars being much more common, and "tobacco beetle" seems a more suitable name. The beetles themselves cause comparatively little damage, for they rarely eat enough to be noticeable, but it is the tunnels and the dusty powder resulting from the activities of the larvae that are chiefly objectionable. In made-up cigars, such holes render the product unsaleable. Dr. W. D. Hunter once said of gift cigars from Havana that heavy infestation indicated the quality of the cigars, but this was cold comfort to the unfortunate giver. Injured cigars do not draw well, burn unevenly, and dust is drawn into the mouth of the smoker. Infestation may occur at any time: from the time the green tobacco is hung up in the drying shed until the finished product is in the hands of the consumer. The dust-filled cracks and crevices of old tobacco factories, and piles of discarded refuse are almost invariably infested with all stages of this small beetle, and in one case in Puerto Rico, an exceptionally heavy infestation developed in tobacco hung in a drying shed in which was stored infested cotton seed meal, intended to be used for fertilizer.

Mr. Joseph N. Tenhet, inspecting tobacco storage warehouses in Puerto Rico in August 1949, found practically no live adults. On compiling the records of injury on file at the Río Piedras Station, it was found that practically all were during the winter and early spring, with none for the summer and autumn months. Apparently summer temperatures prevent injury, while winter temperatures, especially in the mountains, are much more favorable for the development of this pest. This suggests that as a practical measure of control, storage at temperatures varying considerably from those of winter in Puerto Rico might be reasonably effective.

Neither Dr. Stahl nor Dr. Gundlach note the presence in Puerto Rico of *Lasioderma serricorne*, and it seems hardly possible that it could have been present and they did not have its damage brought to their attention. In 1910, however, Mr. W. V. Tower, at the Mayagüez Station, reported "a beetle borer in tobacco warehouses" and started his experiments in fumigation with cyanide which eventually resulted in his taking over the commercial fumigation for the Porto Rico-American Tobacco Co. At the present time, the beetle may be presumed to be in all parts of the Island. The adult is from 2.2 to 3.0 mm. long, elongate-oval, moderately convex, uniform dull reddish-yellow or brownish-red, with a fine uniform recumbent

pubescence on the entire body. The segments of the antennae are triangular, all except the first of approximately of the same size, and not as in *Stegobium panicea*, with the terminal three much larger than the others. The whitish larva is almost as hairy as a Persian kitten, and when fully-grown and about to pupate, compacts its excremental dust into a definite pupation chamber. Possibly the best technical and economic account is "The Tobacco Beetle: an Important Pest in Tobacco Products" (Professional Paper) Bulletin No. 737, U. S. Dept. Agr., pp. 77, fig. 16, pl. 3, ref. 90. Washington, D. C., March 17, 1919) by Mr. George A. Runner.

Petalium puertoricensis Fisher (1936–239) is only 1.22 to 1.75 mm. long, 0.5 to 0.75 mm. wide, "moderately elongate, subopaque, uniformly reddish brown," the type from dead wood or live "ucar" or "moca" trees in the mountains north of Ponce, intercepted by Mr. R. G. Oakley.

Calymmaderus bibliothecarum Poey, listed by Dr. Gundlach as a *Dorcatoma*, was characterized by him as "sumamente dañino, porque la larva perfora libros y destruye colecciones de historia natural, tanto zoológicas como botánicas," but this particular pest of books and natural history collections has not been reported from Puerto Rico since.

Catorama herbarium Gorham has been repeatedly identified by Mr. W. S. Fisher as a pest of the bindings of books in the San Juan region: a considerably larger beetle than *Lasioderma serricorne*, and sometimes accompanying it in destroying book bindings.

Catorama neltumae was recently described by Mr. W. S. Fisher as one of several "New Coleoptera from Puerto Rico" (Jour. Agr. Univ. P. R., **25** (4): 37–39. Río Piedras, April 7, 1942) from an abundance of material reared by Dr. Luis F. Martorell from the seed pods of mesquite or "bayahonda" (*Neltuma* or *Prosopis juliflora*), at Guánica. "This species is related to *Catorama herbarium* Gorham, but differs from that species in being uniformly black on the dorsal surface of the body, in having the pubescence on the pronotum and elytra finer and more silky, the punctures on the elytra irregularly distributed and not arranged in rows, the lateral striae extending only to the middle of the elytron, and the anterior tibia with only one longitudinal sulcus." It is 3.5 mm. long and 2.0 mm. wide.

Catorama insulicola Fisher (1936–240) is only 2.0 mm. long and half as wide, described from specimens intercepted on ucar (*Bucida buceras*) on the beach west of Ponce by Mr. R. G. Oakley.

The other non-economic species of Anobiid beetles intercepted by Mr. R. G. Oakley in the Ponce region which Mr. W. S. Fisher named and described (for three of which Dr. Blackwelder (1945-405 and 406) changes the gender of the specific name to the feminine, ending in **-a**) are:

Cryptorama densipunctatum Fisher (1936–240)

Protheca flavitarsis Fisher (1936–241)

Caenocara insulanum Fisher (1936–242)
Caenocara maculatum Fisher (1936–242)
Caenocara oakleyi Fisher (1936–241).

Aderidae (Euglenidae)

Mr. R. G. Oakley was even more industrious in collecting new species of Euglenids in the coffee groves, on orange trees and on various other hosts in the mountains north of Ponce. Of them, however, Mr. H. S. Barber, of the U. S. National Museum, to whom this material was assigned, has prepared no descriptions, but merely given subgeneric names such as *Ganascus*, *Pseudariotus*, *Sandytes*, *Hylophilus*, *Xylophilus* and *Zonantes*, the only specific determination being **Aderus guttatus** Champion, originally described from St. Vincent and Grenada. This beetle Mr. Oakley repeatedly collected on coffee in the Ponce region, on "moca" (*Andira jamaicensis*), on "roble de pantano" (*Quercus thompsonii*) and on "mato de playa" (*Guilandina crista*); and at Juana Díaz on guava (*Psidium guajava*) and orange.

Lymexylonidae: Ship-Timber Beetles

Atractocerus brasiliensis Laporte & Serville was first noted in Puerto Rico by Dr. Gundlach. "Solamente la he cogido cuando voló a la vela encendida en la casa de campo. Su vuelo es ruidoso o acompañado de un zumbido." It is a slender, elongate beetle, nearly an inch in length, with very small non-functional elytra standing erect on its back, and membranous hind wings reaching a little more than halfway to the apex of the abdomen. When the beetle is at rest, its hind wings are held upright like those of a butterfly. The characteristic noise which it makes in flight is doubtless due to the inadequacy of such short wings, but nevertheless, the insect persists in western Puerto Rico, and repeated collections have been made in the mountains by students of Dr. Danforth. The most recent collections were: at light at Lares in the fall of 1938 by Felipe Mora; at Las Bocas, Utuado in 1941, and at light in Ponce, 1946. Dr. Gundlach did not find it in Cuba, and it is not recorded from any other of the West Indies, but its range is from Mexico thru Central America and tropical South America to Argentina and Chile. Nothing is known of its life-history.

Nitidulidae: Sap-Feeding Beetles

With nothing comparable in the tropics to the abundant flow of sap of maple and other trees in the spring of the temperate zone, Nitidulid beetles occur mostly under the leaf-sheaths of sugar-cane, in rotten cane stalks, or those eaten by rats, as well as in decaying fruit of all kinds lying on the ground. They are small, flattened beetles, having wide, thin side-margins

of the thorax, and elytra often truncate long before the apex, leaving the end of the abdomen exposed.

Colopterus truncatus Randall, synonymous with the *Colastus infimus* which G. F. Erichson described from Puerto Rico (*in* E. F. Germar's "Versuch einer Systematischen Eintheilung der Nitidularien" (Zeit. für die Ent., **14:** 245. Berlin, 1843) has not since been collected here, but Mr. A. J. Mutchler identified specimens in the collection of Dr. Stuart T. Danforth as **Colopterus amputatus** Erichson.

Of **Conotelus fuscipennis** Erichson, now considered as only a variety of **Conotelus conicus** F., which is also separately listed by Dr. Blackwelder (1945–411) from Puerto Rico, Dr. Gundlach notes, "se le encuentra a menudo en el cáliz de las flores." Repeated collections have been made since in the more humid parts of the Island, on many kinds of flowers, such as rose, gardenia, kumquat, "roble" (*Tecoma pallida*) and "emajagua" (*Pariti tiliaceum*), of this exceptionally elongate, dark reddish-brown, spindle-shaped beetle, which has less than half the length of its tapering abdomen covered by its elytra.

Carpophilus dimidiatus F. has been found in abundance in flour and corn meal in Puerto Rico, in stored mahogany seed at Cayey, and Prof. J. A. Ramos reports it from Mona Island. The cosmopolitan variety **mutilatus** Erichson is listed from Vieques Island by Leng & Mutchler.

Carpophilus hemipterus L., as identified by Dr. E. A. Schwarz, was found in decaying cane seed at Río Piedras, only a single record, but actually this is a common insect in rotten seed or rat-eaten cane, which nobody since Mr. Thos. H. Jones has bothered to collect. It is black, with prominent large subtriangular yellow spots at the apex of the elytra.

Carpophilus (Urophorus) humeralis F., as identified by Dr. E. A. Chapin, was found on the ground at Arecibo under rotten fruits of "almendra" (*Terminalia catappa*) and of "jobo de la India" (*Spondias dulcis*).

Carpophilus tempestivus Erichson, as determined by Mr. W. S. Fisher, was found by Mr. R. G. Oakley on rotten oranges at Ponce. Undetermined species have been found in rotten maga pods at Vega Baja, and Dr. Wetmore reports finding these beetles eaten by the martin.

The yellow elytra of **Haptoncus luteolus** Erichson almost cover its short abdomen. Judging by the number of times it has been collected, it is by far the most abundant of Puerto Rican Nitidulids: under leaf-sheaths of sugar-cane, in cane chewed by rats, on tassels of corn, in rotten oranges, in rotten grapefruit, in rotten fruit of "jobo" (*Spondias mombin*), in rotten fruit of "jobo de la India" (*Spondias dulcis*), in rotten fruit of "níspero" (*Sapota achras*), in rotten fruits of "caimito" (*Chrysophyllum cainito*), in rotten fruits of "limón de Jerusalén" (*Triphasia trifolia*), and in rotten

pods of *Inga laurina*. Dr. Gundlach lists it as an *Epurma*, and Dr. Wetmore notes that it was eaten by a flycatcher. It has been repeatedly collected at light on Mona Island.

A small beetle identified as a species of **Epuraea** by Dr. A. E. Chapin has been collected at Mayagüez.

The cosmopolitan **Stelidota geminata** Say and the West Indian **Stelidota ruderata** Erichson are listed by Dr. Gundlach, and Dr. Wetmore found these beetles to have been eaten by the swift and the cliff swallow. Dr. Stuart T. Danforth collected them in large numbers from decaying citrus fruits in the Mayagüez region and in the mountains, at Las Marías and Maricao. Their distribution is general wherever citrus fruits are grown in Puerto Rico, altho the most eastern record is at Bayamón.

The very small dark brown **Stelidota strigosa** Gyllenhal, as determined by Dr. E. A. Chapin, was collected by Prof. J. A. Ramos on Mona Island.

Lobiopa insularis Castelnau, listed by Drs. Stahl and Gundlach as *Lobiopa decumana* Erichson, and thus identified for Dr. Danforth by Mr. A. J. Mutchler, is 6.0 mm. long, with the apex of its elytra rounded, lateral margins of prothorax and elytra thin and semitransparent yellowish. Mr. E. G. Smyth noted adults and larvae under rotten fruits of guava (*Psidium guajava*) on the ground at Río Piedras, and it has also been found under rotten fruit of "jobo" (*Spondias mombin*). Most records are from citrus fruits lying rotting on the ground, Dr. Stuart T. Danforth and students having made repeated collections in the Mayagüez region, at Las Marías and Maricao, and Mr. R. G. Oakley having intercepted it in the mountains back of Yauco, at Indiera. Adults may hide under the bark of trees, and have been attracted to light at Bayamón.

Dr. A. G. Böving identified as a species of **Glischrochilus** the beetles which Mr. R. G. Oakley found in rotten orange fruit at Ponce.

Cucujidae: Flat Bark Beetles

The early records of **Laemophloeus adustus** Leconte, listed by Dr. Gundlach, and of **L. bituberculatus** Reitter and **L. unicornis** Reitter, have not been confirmed by later collections, but unidentified species of this genus: minute, flattened, oblong reddish-brown beetles, were found under the bark of trees and in decaying wood by Dr. Donald De Leon when making his survey of forest insects of Puerto Rico in 1940.

The cosmopolitan flat grain beetle, **Laemophloeus minutus** Olivier, has been repeatedly found in wheat flour, in macaroni and in soup pastes, as well as in garden seeds and chocolate.

Silvanus bidentatus F., as identified by Mr. W. S. Fisher, was collected by Prof. J. A. Ramos at Mayagüez, Ponce and Humacao.

Herr Ferd. Nevermann of Costa Rica identified for Dr. Stuart T. Danforth some beetles collected at Mayagüez as **Silvanoprus scuticollis** Walker.

The foreign grain beetle, **Ahasverus advena** Waltl, was listed from Puerto Rico by Dr. Gundlach as a *Silvanus*, and by Riley & Howard (*in* Insect Life, **6**: 218. Washington, D. C., February 1894) as a *Cathartus*. It has since been intercepted in green lima beans and in dry pigeon peas at Bayamón, in the dry pods of *Inga laurina* at Juana Díaz, and most recently under the bark of a dead tree on Mona Island.

Ahasverus rectus Leconte, as identified by Mr. W. S. Fisher, was found in abundance on Mona Island by Prof. J. A. Ramos (1947–35), having previously been noted in pigeon peas at Bayamón.

The cosmopolitan **Cathartus quadricollis** Guérin-Méneville (= *C. cassiae* Reiche, under which name it was originally reported) was also collected in pigeon peas at Bayamón, and Prof. A. J. Ramos found them in abundance in tamarind pods at Faro de Cabo Rojo.

The saw-toothed grain beetle, **Oryzaephilus surinamensis** L., is a common pest of stored food products in Puerto Rico, having been found in corn, rice, dry dates, chocolate candy, raisins, walnuts, almonds, and most recently in babassú nuts, *Orbiginia speciosa*.

Monamus concinnulus Walker, as determined by Mr. W. S. Fisher, has been collected on bananas, grapefruit and pomarrosa (*Eugenia jambos*).

Nausibius clavicornis Kugelann, listed by Drs. Stahl and Gundlach as *N. dentatum* Marsham, has repeatedly been found since in brown sugar.

The German consul in Mayagüez, Herr Leopold Krug, who was instrumental in inducing Dr. Gundlach to visit Puerto Rico, was himself much interested in entomology, and in 1871 brought to Germany specimens of beetles which he had collected from the Mayagüez region. It was not until 1932, however, that Herr Ferd. Nevermann, of San José, Costa Rica, a specialist in the Cucujidae, described in his "Beitrag zur Kenntnis der Telephanus (Col. Cucujidae)" (Stettiner Ent. Zeitung, **93** (1): 1–35, pl. 2, Stettin, 1932) these specimens, collected sixty-one or more years previously, and untangled the nomenclature of the West Indian species. Later, he identified the light yellow, unmarked species common in Puerto Rico which hides during the daytime under the leaf-sheaths of sugar-cane. This is **Telephanus pallidus** Reitter, which he considered, if anything, to be a beneficial insect, as at night both larvae and adults feed on fungus spores. **Platamus** ? (**Telephanus**) **pallidulus** Chevrolat with which it has been confused, is quite a different species, most often found on withered banana leaves, but also present in grapefruit groves and on *Inga laurina*, or forest vegetation, and found in Cuba as well as in Puerto Rico.

Telephanus cubanus Nevermann (1932–28) was described from 41 speci-

mens in the Krug collection from Cuba and two from Puerto Rico, having five spots on the elytra forming an elongated pentagon.

Telephanus megacephalus Nevermann (1932–12) was described from three Puerto Rican specimens in the Krug collection, their most obvious character being a broad dark median band across the elytra.

Europs apicalis Reitter (in the older classification placed in the family Monotomidae), first determined from Puerto Rican material by Dr. E. A. Schwarz, was in pods of *Inga laurina* at Lares, but has since been found in the flowers of this coffee shade tree at Mayagüez and Adjuntas. It has been reared by Messrs. Richard Faxon and A. S. Mills from the seed pods of "maga" (*Montezuma speciosissima*) at Vega Alta.

The Cucujid Beetle, *Telephanus pallidus* Reitter, twelve times natural size. (Drawn by G. N. Wolcott.)

Europs maculata Grouvelle has been found in rotten papaya fruit at Arecibo, and under bark of almácigo at Guayama. Prof. J. A. Ramos found an undetermined species of *Europs* on Mona Island.

Smicrips palmicola LeConte, identified by Mr. W. S. Fisher as *S. hypocoproides* Reitter, was first found in Puerto Rico in rotten papaya fruit at Arecibo, but later collections have been made from the seed pods of mesquite or "bayahonda" (*Nelluma* or *Prosopis juliflora*).

Cryptophagidae: Silken Fungus Beetles

Hapalips filum Reitter are small beetles collected at Río Piedras and Ponce, identified by Mr. W. S. Fisher, which are now in the Mayagüez College of Agriculture collection.

The little beetles of the genus *Loberus*, superficially resembling some of the flea-beetles of the family Chrysomelidae, are represented in Puerto Rico by three or more species. **Loberus mutatus** Grouvelle, as identified by Mr. W. S. Fisher, has been intercepted in betel palm at Adjuntas, where also another species has been found on orange by Mr. R. G. Oakley.

The beetles found by Dr. Luis F. Martorell on watermelon vines on Mona Island, were identified by Mr. W. S. Fisher as a species of **Loberus** "not *mutatus* or *testaceus*," and later collections by Prof. J. A. Ramos (1947–36) sweeping vegetation on Sardinera and Uvero Beaches indicate that they are quite abundant on Mona.

Loberus testaceus Reitter is presumably the more common species, listed by Leng & Mutchler (1917–202) and identified for Dr. Stuart T. Danforth by Mr. A. J. Mutchler, the specimens from Boquerón. Without being specific, Dr. Wetmore notes these beetles eaten by the tody and the flycatcher, and they also form an item of food for the lizards *Anolis stratulus* and *Anolis cristatellus*. They have been found in the most diverse environments: in pink bollworm-injured cotton bolls at Pt. Cangrejos, in buds of "emajagua" (*Pariti tiliaceum*) at Arecibo, in pods of *Acacia farnesiana* at Boquerón, in dry pods of *Crotalaria incana* on the Mayagüez Playa, on leaves of *Inga laurina* and on tamarind flowers at Juana Díaz, and on the ground at Ponce, but it is quite possible that these do not all refer to the same species.

Phalacridae: Shining Flower Beetles

Phalacrus acutangulatus Chevrolat, previously known only from Peru, is the identification by Mr. A. J. Mutchler of some little oval shining black beetles found in cotton bolls at Pt. Cangrejos. Others, less highly polished but twice as large, at times abundant at light at San Juan and Río Piedras, have not been identified as to species. Those attracted to light on Mona Island have been identified as a species of **Acylomus** by Mr. W. S. Fisher.

Anthicidae: Ant-Like Flower Beetles

Of all the ant-like flower beetles, **Notoxus bipunctatus**, described from Puerto Rico by L. A. Auguste Chevrolat (Ann. Soc. Ent. France, (5), VII: ix. Paris, 1877) is immediately recognized by "the thoracic horn which extends in a sort of hood over the head," and the not so prominent posterior spot on each elytron. It was re-described by G. Quedenfeldt, the type from Puerto Rico, as *Notoxus krugii*, but Dr. Gundlach lists only **Notoxus dentipennis**, described by Chevrolat from Puerto Rico on the same page. The latter has not since been collected here, but the former has been taken at light at Pt. Cangrejos, Mayagüez and Ponce, and Mr. R. G. Oakley found it resting on ucar (*Bucida buceras*) at Ponce.

The beetles which Mr. R. G. Oakley found on the flowers of *Randia mitis* and other trees near Ponce were identified by Mr. H. S. Barber as a species of **Amblyderus**.

Anthicus floralis L., listed by Drs. Gundlach and Stahl, and by G. Quedenfeldt and Leng & Mutchler, was found by Dr. Wetmore to be an item in the food of the yellow-shouldered blackbird. These slender little reddish-brown beetles were found once in abundance in the central whorl of young shoots of sugar-cane at Arecibo, but we have no lead as to their role in a normal environment, for all other collections were at light: by Mr. R. G. Oakley at Ponce and by Prof. J. A. Ramos on Mona Island.

Dr. E. A. Schwarz tentatively identified as **Anthicus fulvipes** LaFerté two beetles which Mr. Thos. H. Jones found on the underside of aphid-infested okra leaves at Río Piedras, and this species has since been collected on flowers of flamboyán (*Delonix regia*) at Juana Díaz.

Anthicus vicinus was described by Marquis F. Thibauld de la Ferté-Sénectére on page 157 of his "Monographie de *Anthicus* et gen. voisins" (Paris, 1848) from "America borealis," but actually the type was from Puerto Rico. Herr G. Quedenfeldt (1186–122) re-described the same insect under the name of *fulvomicans*, and this was the name used by Drs. Gundlach and Stahl in their lists. It has since been found under fresh cow dung at Guánica by Mr. G. B. Merrill, as identified by Dr. E. A. Schwarz: a ferrugineous shining beetle, not pubescent, legs lighter in color, elytra densely punctate, dark at apex and about the middle. Apparently it is quite common in the xerophytic part of Puerto Rico, for numerous subsequent collections have been made under dung at Guánica and Ponce.

Lathridiidae: Minute Brown Scavenger Beetles

"**Eufallia unicostata** (Belon), a Fungus Eating Beetle new to Puerto Rico" (Jour. Ec. Ent., **33** (5): 810–11. Menasha, October 1940) was found by Dr. W. A. Hoffman in great abundance on the casein-covered walls of the School of Tropical Medicine at Puerta de Tierra, feeding on their fungus-discolored surfaces during wet weather.

Mr. W. S. Fisher identified as a species of **Melanophthalma** some beetles which Mr. R. G. Oakley collected on coffee in the mountains back of Ponce. This may be what Dr. Gundlach lists as "*Lathridus fasciatus* es su nombre en la colección del Museo de Berlín."

Coccinellidae: Ladybeetles

No injurious ladybeetle is known to occur in Puerto Rico, the Mexican bean beetle or bean ladybird, *Epilachna varvestis* Mulsant (= *E. corrupta* Mulsant) being a pest of beans only in Central America northward from Panama to Mexico and the southern United States. Of *Epilachna patricia*

Mulsant, recorded from St. Croix in the Virgin Islands, we have no record of its host plant, and it is not even listed by Harry A. Beatty in his "Fauna of St. Croix, V. I." (Jour. Agr. Univ. P. R., **28** (3–4): 103–185. Río Piedras, July 7, 1947).

Psorolyma maxillosa, in the "Descriptions de Varietes, Especes et Generes nouveaux appartenant a la Famille des Coccinellides" (Ann. & Mag. Nat. Hist., **9** (9): 349–360. London, April 1922) by A. Sicard was described as "ovalis, convexa nitida, coerulea; subtus piceo-brunnea; antennis, palpis, pedibusque pallide flavis. Mandibulis exsertis, oculis prominentibus distinctissimus. Long 2.5 mm." was from a type collected at Lares. This ladybeetle is common in coffee groves everywhere on the Island, but is possibly most abundant at the higher elevations, as at Indiera. Dr. Stuart T. Danforth's collection includes specimens from El Yunque, as well as from Cartagena Lagoon. The larva is grey with black spots, and often two or three occur on a single coffee leaf, without apparent source of animal food. Rarely are they found on coffee leaves infested with the aphid *Toxoptera aurantiae*, and we do not know what either larvae or adults eat. The beetles themselves are eaten by the lizard *Anolis gundlachi*. Other native ladybeetles are often snapped up by lizards, and indeed lizards prove to be one of the greatest hazards encountered in releasing introduced ladybeetles, appearing just as the shipping cage is opened and catching and swallowing the beetles, sent from abroad with such care and expense, before they can make even the first adjustment to their new environment.

Scymnodes lividigaster Mulsant is an introduced ladybeetle. Dr. Francis X. Williams, on p. 183 of his "Handbook of the Insects and other Invertebrates of Hawaiian Sugar Cane Fields" (Experiment Station of Hawaiian Sugar Planters' Assn., pp. 400, fig. 190, pl. 41. Honolulu, 1931) under the name *Platyomus lividigaster* (Muls.), describes it as "a hairy, shining black species, about 3.0 mm. long, with a large yellow spot occupying each side of the thorax above. The abdomen seen from beneath is reddish. It is well distributed but rather uncommon in the (Hawaiian) Islands, and is an importation by Koeble from Australia in 1894." A shipment of this beetle was made from Hawaii in 1938, of which a liberation was made at Lajas. "In general, the beetles did not appear to be particularly voracious on *Sipha flava*, but some feeding was observed in the laboratory."

Rodolia cardinalis Mulsant, the internationally famous Australian ladybeetle, was introduced into Puerto Rico from Florida in 1932 for the control of the cottony cushion scale. For a considerable number of years, a colony of living beetles was maintained in the laboratories of the Experiment Sta-

tion at Río Piedras, so that some might be immediately available to control any outbreak of this scale as soon as it was reported by the worried citrus grower. Presumably this was a service much appreciated, but in many cases the entomologist, bringing a supply of beetles or larvae for release where cottony cushion scale had never before been found, would discover the Australian ladybeetles already present by natural dispersion. Thus paralleling the spread of the scale, it became dispersed along the north coast of Puerto Rico and by 1940 had appeared in the mountains back of Mayagüez. In the region around San Juan, where it had once been temporarily very abundant, it could no longer be found, because other factors in the natural control of cottony cushion scale, added to its own efforts, had eliminated this, its only source of food.

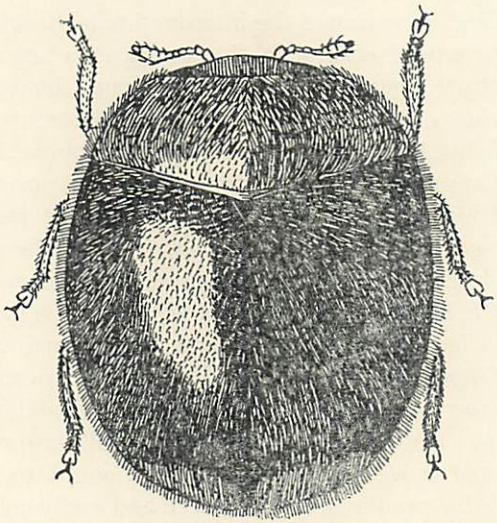
The planting of scale-infested beefwood (*Casuarina equisetifolia*) seedlings on Mona Island, brought from nurseries at Río Piedras, established the scale there, and necessitated the introduction of *Rodolia*. Some of the other factors in natural control in Puerto Rico do not exist or are less effective, thus "Introduced Ladybeetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, June 1944) find there a continuous supply of food sufficient "to maintain a reserve of ladybeetles from which they may be obtained in sufficient numbers to supply the very rare needs of Puerto Rico." Forced by stern necessity, *Rodolia* in recent years has survived feeding on the endemic *Icerya montserratensis*, as in the plaza of Manatí, and no sooner does an outbreak of *Icerya purchasi* get well started, as at Palo Seco in 1945, and at Bayamón in 1947, before the ladybeetles appear and proceed to eliminate it. The brilliant cardinal red and shining black of the adults of *Rodolia cardinalis* should make them conspicuous, but in reality they are very hard to find, and especially to catch in large numbers in a citrus grove. On casuarina, however, the fully-grown larvae migrate from scale-infested twigs to the needles when about to pupate, and the pupae far out on the needles are readily seen and easily collected, while one judges of the former abundance of the insect by noting the empty pupal skins still attached to the casuarina needles.

Stethorus punctum Le Conte, a continental North American species, was specifically re-determined by A. Sicard, confirming the tentative identification by Dr. E. A. Schwarz as "close to *punctum* Lec." of the minute little black ladybeetles which Mr. Thos. H. Jones had found on leaves of "bucare" (*Erythrina glauca*) infested with mealybugs, and Mr. E. G. Smyth had later noted on jobo and guava leaves infested with thrips and whiteflies. It has since been found in considerable abundance on the leaves of sugar-cane at Loíza heavily infested with the green red spider, *Tetranychus sacchari* McGregor, and may be a factor of considerable im-

portance in the control of this new minor pest. These beetles identified by Dr. E. A. Chapin only to genus, were found on Mona Island by Dr. Luis F. Martorell on leaves of castor bean infested by lace bugs.

Mr. S. M. Dohanian, when engaged in "The Importation of Coccinellid Enemies of Diaspine Scales into Puerto Rico" (Jour. Agr. Univ. P. R., **21** (2): 243–7. Río Piedras, July 1937) from Trinidad, included in his shipments of beetles collected on scale-infested coconut palms the comparatively rare **Scymnus aeneipennis** Sicard. Only seventeen of these beetles were actually sent to Puerto Rico, and none has been collected here since the release in January 1936.

Dr. Stanley E. Flanders has identified as **Scymnus flavifrons** Melsheimer some beetles accompanying *Saissetia nigra* material received from Puerto Rico.

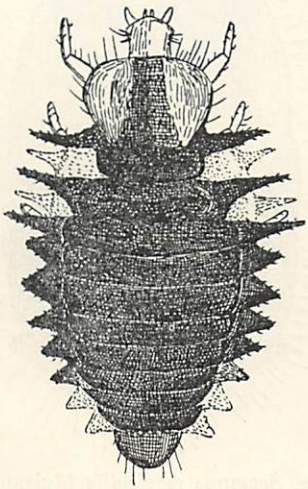


The Ladybeetle, *Scymnus roseicollis* Mulsant, thirty times natural size. (Drawn by G. N. Wolcott.)

Scymnus floralis F., listed by Dr. Gundlach from Puerto Rico, was collected by Prof. J. A. Ramos (1947–36) on Mona Island.

The little oval ladybeetle which the economic entomologist identifies by the orange prothorax and the orange apex of black elytra, earliest considered as a variety of *floralis*, but subsequently identified by Dr. E. A. Schwarz as **Scymnus roseicollis** Mulsant, is very common in Puerto Rico. Messrs. D. L. Van Dine and Thos. H. Jones were first to note its importance as a predator on the yellow aphid of sugar-cane, *Sipha flava* Forbes, and by the latter as attacking *Aphis setariae* Thos. on the same host. Mingled

with the aphids, one often notes the larvae of these ladybeetles, mostly black with retractile protuberances on the back. In reality, these almost omnipresent ladybeetles are not at all fussy about which particular kind of aphid serves as their food, and recent records are of their attacking *Aphis gossypii* Glover on cucumbers and okra, and resting on many other plants. With such characteristically marked elytra, their presence could be readily determined for Dr. Alex. Wetmore to report as items in the food of the tody, wood pewee, vireo, redstart, honey creeper and the yellow and parula warblers. Rather surprisingly, none was found in the stomachs of lizards. On Mona Island, Dr. Luis F. Martorell found them on the underside of castor bean leaves infested with lace bugs, and Prof. J. A. Ramos swept them from vegetation.



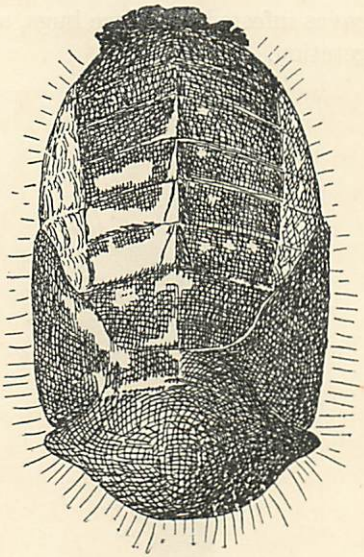
Larva of the Ladybeetle, *Scymnus roseicollis* Mulsant, forty times natural size. (Drawn by G. N. Wolcott.)

Scymnus phloeus Mulsant, formerly "frequently identified as *S. loewii* Muls., all records of *S. loewii* from the West Indies being certainly *phloeus*" according to Dr. E. A. Chapin, was listed from Puerto Rico by Dr. Gundlach. It has elytra laterally broadly margined with orange, the prothorax and median line of the elytra black. Judging by the records, it is not as common as *roseicollis*, but has almost identical habits. Dr. Wetmore found it in not a single bird stomach, nor was it found to have been eaten by lizards.

Scymnus thoracicus F., listed by Dr. Gundlach with **Scymnus ochroderus** Mulsant in synonymy, has not since been collected in Puerto Rico. "*Diomus thoracicus* Fabr., the type of the genus *Diomus*, and other species

including *D. roseicollis* Muls. of the West Indies, possess antennae of eleven segments and tarsi of four segments," according to Dr. E. A. Chapin (1933–95), *Diomus* being a subgenus of *Scymnus* as listed by Dr. R. E. Blackwelder (1945–444), and these two species distinct.

When most intensive studies were being made of the natural enemies of the cottony cushion scale, *Icerya purchasi* Maskell, after its initial occurrence and rapid spread in Puerto Rico, other ladybeetle larvae were noted, not associated with those of *Rodolia cardinalis*, on the exposed beach at Dorado where the introduced Australian ladybeetles failed to thrive.



Pupa of the Ladybeetle, *Scymnus roseicollis* Mulsant, forty times natural size. (Drawn by G. N. Wolcott.)

They pupated when much smaller than the introduced *Rodolia*, and emerged a few days later as light red beetles with two large black spots on each elytron. A technical "Description of the Larva of **Decadiomus pictus** Chapin (Scymnini, Coccinellidae)" by Dr. Adam G. Böving (Proc. Biologial Soc., Washington, **46:** 101–4, pl. 1. Washington, D. C., April 27, 1933) complements the naming and description of the adult of this new ladybeetle by Dr. E. A. Chapin in "A New Genus of West Indian Coccinellidae (Coleoptera)" in the immediately preceding pages (95–99, pl. 1) of the same journal. This endemic ladybeetle must have been predaceous on some other insect before the cottony cushion scale occurred in Puerto Rico, and the subsequent extreme scarcity of its adopted host is possibly one reason why it has since been found feeding on scale insects

of coconut palm at San Juan, and intercepted at Ponce and Yauco by Mr. R. G. Oakley, not associated with any host. *Decadiomus pictus* is "flesh-pink to red, ornamented with piceous to black markings,—length 1.6 mm."

Decadiomus tricuspis Chapin (1933–98) is "very pale stramineous (almost white)—length 1.0 mm.," the type collected on papaya at Río Piedras by Dr. H. L. Dozier, who characterized the larvae, feeding on whiteflies, *Metaleurodicus variabilis*, and the pupae as being "soiled white, without markings, and covered with fine hairs."

"The mealybug destroyer, **Cryptolaemus montrouzieri** Mulsant," according to Dr. E. O. Essig on p. 415 of his "Insects of Western North America," "is 3.0 to 3.5 mm. long, shining black, with the head, prothorax, tips of the elytra, and abdomen reddish. The minute oval eggs are yellow and are laid singly among the hosts. The larvae are yellow and entirely covered with long white waxy filaments. When mature they are 7.0 to 10.0 mm. long, and are often mistaken for huge mealybugs. The species was introduced from Australia into California in 1892 by Albert Koeble and has proven to be one of the most proficient enemies of the many kinds of mealybugs in California where it is firmly established." It was the first ladybeetle to be introduced and to become established in Puerto Rico. Mr. D. L. Van Dine, Entomologist of the Sugar Producers' Experiment Station at Río Piedras, had distributed it by 1911 thruout the cane districts of the Island, and had recovered it in the field. When reared in captivity, furnished mealybugs from sugar-cane for food, it accepts them without question and appears to thrive on a diet composed exclusively of this one kind of mealybug. When released, however, it finds these mealybugs protected by cane leaf-sheaths much too difficult to reach, by comparison with the numerous exposed mealybugs and soft scale insects present in Puerto Rico. Indeed, the first authentic record of finding *Cryptolaemus montrouzieri* living in a cane field was by Dr. H. L. Dozier more than a dozen years later, feeding not on the protected mealybugs, but on *Pulvinaria iceryi* Guérin-Méneville, a soft scale insect normally occurring on sugar-cane, but in only this one case in sufficient abundance to attract these imported ladybeetles into a cane field. Another soft scale, *Pulvinaria psidii* Maskell, is often common on "palo de muñeca" (*Rauwolfia nitida*), and when its leaves are noted blackened by sooty mold from the scale, one can usually find some of these ladybeetles present. On trees of "jobo" (*Spondias mombin*), each dry autumn at Río Piedras *Pulvinaria psidii* formerly became so abundant as to cause an early shedding of the leaves, and great clusters of the scale and their waxy secretions accumulated on the underside of each leafless twig and branch. One never sees such mass infestations since the introduction of *Cryptolaemus*. The introduced scales *Icerya purchasi* Maskell and *Coccus viridis* Green are also eaten to some

extent, and the common exposed mealybugs *Pseudococcus citri* Risso, *Pseudococcus adonidum* L., and *Pseudococcus nipae* Maskell.

Scymnillus nunenmacheri Sicard (1922–355) is the only endemic scale-feeding ladybeetle normally to be found in Puerto Rican citrus groves. It is iridescent blue-black, 1.2 to 1.5 mm. long, and feeds on other diaspine scale insects, as on coconut palms and cycads, Dr. Luis F. Martorell finding it even attacking the mealybug *Pseudococcus nipae* Maskell on leaves of "anacagüitas" (*Sterculia apetala*) at Ponce. It is rarely sufficiently abundant in citrus groves or coconut groves to be much of a factor in the natural control of scale insects.

Scymnillus variipennis Sicard (1922–354), a small light brown ladybeetle, present with its bluish-grey larvae and reddish-brown puparia in great abundance on the leaves of coconut palm infested with *Aspidiotus destructor* Signoret at Río Piedras, has since been found in comparable abundance on coconut palms at Ponce. Dr. R. T. Cotton observed them feeding on mealybugs in grapefruit groves, and collected them on guava leaves infested with mealybugs and whiteflies, and on jobo leaves infested with thrips. Dr. Alex Wetmore reported species of *Scymnillus*, presumably this or the preceding, had been eaten by the tody, wood pewee, vireo and various warblers, and by the honey creeper or "reinita". None of these minute ladybeetles was found in the stomachs of the lizards examined, but it may be presumed that they are eaten by lizards when an opportunity is presented.

Of **Zilus cyanescens,** described by A. Sicard as a *Scymnillodes* from Jamaican specimens, characterized as "subrotundus, convexus, nitidus, supra cyaneous; antennis flavis, palpis rufis; subtus nigro-brunneus; pedibus rufis", he subsequently differentiated the Puerto Rican variety **violaceous** with "elytris violaceo-micantibus, prothorace angustiore". The types of this variety were collected from coconut palm infested with *Aspidiotus destructor* Signoret, but subsequently Dr. Richard T. Cotton noted them in considerable abundance feeding on *Asterolecanium bambusae* Boisduval on bamboo at Vega Baja, apparently the only record of an endemic ladybeetle attacking this scale.

Dr. E. A. Chapin, in describing "New Coccinellidae from the West Indies" (Jour. Washington Academy of Sciences, **20** (20): 488–495. Washington, D. C., December 4, 1930) presents the new name **Scymnillodes caseyi** for Casey's *Delphastus violaceus*, of which he noted two specimens collected "from Maricao, Porto Rico, July 2, 1917 by Harold Morrison".

Zilus gilvifrons, the types collected at Maricao by Dr. Harold Morrison, was described as a *Scymnillodes* by Dr. E. A. Chapin (1930–493). It has "metallic violaceous elytra", and is "easily recognizable by the brilliant

yellow pubescence on head and pronotum, length 1.5 mm." It has been repeatedly collected since in coffee groves in the mountains, and in orange groves, but without definite record as to the insects on which it was feeding.

A shipment containing 146 live **Hyperaspis billoti** Mulsant, collected in Trinidad by Dr. K. A. Bartlett, was opened in Río Piedras on February 9th, 1939, and the ladybeetles released on a small wild orange tree heavily infested with *Selenaspidus articulatus* Morgan. Most of the ladybeetles promptly took flight, and of those which remained in the scale-infested tree, several disappeared inside a crested lizard which had suddenly become interested when these little beetles began to emerge from the package. The scales shortly afterwards disappeared from the orange tree, but whether this was due to the introduced ladybeetles could not be determined by repeated observations. None of the descendants of these beetles has since been collected in Puerto Rico.

In contrast to the introduced ladybeetles from Australia that prefer unprotected and exposed mealybugs, rather than those hidden under the leaf-sheaths of sugar-cane, **Hyperaspis trilineata** Mulsant of Barbados is normally to be found only feeding on those of sugar-cane. This is quite a large ladybeetle, 4.0 mm. long, mostly dull orange in color, with the median margin and an elongate stripe on the elytra black, forming the "three lines" of the specific name. In life, both larvae and adults are usually whitened with the wax of their host, with which they are so closely associated under the cane leaf-sheaths. Repeated sendings of this beetle were made by Mr. R. W. E. Tucker in 1932 to 1935, and releases made in all parts of Puerto Rico. No recoveries have been made to date, and it seems doubtful if this ladybeetle became established in Puerto Rico.

Hyperaspis connectens Thunberg has two large dull orange spots on each black elytron connected to form a large "C", but the smaller and often more yellowish spots of **Hyperaspis festiva** Mulsant, aberation **apicalis** Weise, are joined, if at all, only narrowly on the lateral margin. Both species are listed by Dr. Gundlach. Dr. Wetmore found remains of the latter in the stomach contents of the martinique, the parula warbler, and the martin, while Dr. Danforth found that it had been eaten by the golden warbler. In every case where these ladybeetles are found associated with a host, this has invariably been aphids; most often *Sipha flava* Forbes on sugar-cane, but also *Aphis gossypii* Glover on cotton. Often they are found singly on plants not infested with aphids, but they are so constantly associated with the yellow aphid of sugar-cane, and in such numbers, that one may consider them as a major factor in its natural control.

Cryptognatha nodiceps Marshall and **Cryptognatha simillima** Sicard were found in abundance in Trinidad on coconut palms by Mr. S. M. Dohanian, who sent 646 of the former and 94 of the latter to Puerto Rico for release

in coconut groves. This was in sufficient numbers so that the former, at least, became firmly established here.

Delphastus nebulosus, described by Dr. E. A. Chapin as one of the "New Genera and Species of Ladybeetles related to *Serangium* Blackburn (Coleoptera: Coccinellidae)" (Journal Washington Academy of Sciences, **30** (16): 263–272, fig. 24, ref. 13. Washington, D. C., June 15, 1940), is characterized by being "pale yellow-brown, legs whitish, elytra each with a single basal castaneous spot of indefinite extent, length 1.0 mm., width 0.8 mm.". It was described from a type intercepted by Mr. R. G. Oakley at Villalba, but collections had been made long previously by Mr. Thos. H. Jones at Río Piedras, and at Martin Peña on bushes of guava (*Psidium guajava*) heavily infested with whiteflies. Large numbers of adults and larvae were found on a papaya tree at Isabela heavily infested with white scale in April 1939, and collections have also been made at Barceloneta and Ponce.

Pentilia insidiosa Mulsant (= *P. castanea* Mulsant) was first collected for importation into Puerto Rico by Mr. S. M. Dohanian on coconut palms in Trinidad, but later shipments were made by Dr. K. A. Bartlett, as related in his "A Search in Guianas and Trinidad for Predatory Beetles on the Bamboo Scales" (Jour. Agr. Univ. P. R., **22** (4): 493–5. Río Piedras, March 23, 1939), and were reared in the laboratory at Mayagüez, releases being made only of reared material. In succeeding years, these light to dark chestnut brown beetles were reported as being "well distributed" and "notably active" in the Mayagüez region. Dr. Bartlett at the same time sent a species of *Pentilia* that was dark brown in color, with red spots on the elytra, and another *Pentilia* which was "a solid dark brown".

Pentilia egena Mulsant, a shining hemispherical black ladybeetle of Brasil, was collected for shipment to Puerto Rico by Dr. K. A. Bartlett, and later shipments were made by Dr. Felisberto C. de Camargo from Campinas, Sao Paulo. A very similar ladybeetle, but blue-black in color, found several years before the introductions at Mayagüez, in considerable numbers in the stomachs of crested lizards from the Condado beach, was identified by Dr. E. A. Chapin as a species of **Pentilia.**

The densely pubescent black ladybeetles with a large circular spot of shining black on each elytron, tentatively identified by Mr. Harold E. Box as **Azya orbigera** Mulsant, which he collected in Venezuela in 1926 feeding on the hemispherical scale, were sent by him to Puerto Rico as pupae. Thirty beetles emerging were released in the Condado, and an equal number placed outdoors at Río Piedras in a wire cage over a coffee tree infested with *Saissetia hemispherica.* After the second generation of beetles had begun to develop in captivity, the wire cage was removed. In 1940, Dr. K. A. Bartlett reported the introduction of this or a similar

species, collected in Brasil, of which releases were made in the environs of Mayagüez.

The elytra of **Azya trinitatis** Marshall are blue-black in color, evenly but much less densely pubescent than the prothorax. Mr. S. M. Dohanian collected this ladybeetle in Trinidad, feeding on the scales on coconut palm. Only 11 beetles were sent to Puerto Rico by him, but additional shipments were subsequently made and by 1938 the species was considered "well established" in the environs of Mayagüez. Prof. J. A. Ramos has since collected it feeding on coconut scales at Guánica and Ponce.

Ladoria desarmata Mulsant was sent from Brasil by Dr. K. A. Bartlett, but only seven beetles arrived in Puerto Rico.

Each elytron of the black **Chilocorus cacti** L. bears a large dark crimson spot, and the comparable continental *Chilocorus bivulnerus* Mulsant is called the twice-stabbed ladybeetle. Subsequent to the initial introduction of a few of these beetles from Texas, a large number was sent from Cuba, and reared at Mayagüez on white scales on papaya trees outdoors under screen cages. The large beetles are so conspicuous as to fall an easy prey to lizards, as on the naked trunk of a papaya they have no protection. It would appear, however, if even one female beetle escapes and lays her eggs, the gregarious larvae will soon clear a large area on the papaya trunk of all large live scales, and succeeding generations may largely eliminate the scale from that and adjacent trees, and may entirely clear a grove in time. These ladybeetles were originally introduced into Puerto Rico in the expectation that they would feed on the scales on bamboo, but they by no means confine their attention to one species of scale insect. They eat both the white and the grey scales on papaya, and the scales on coconut palms, besides numerous other scales on wild hosts. It has been noted in citrus groves that they appear to have cleaned some trees of all live scale, and they might have been an important factor in the natural control of scale insects of grapefruit, if their introduction had occurred earlier when the production of grapefruit was a thriving industry. Indeed, on the ornamental shrub *Acalypha wilkesiana*, where the beetles are well protected by the dense reddish foliage from being easily caught by lizards, they may be not only commercially but actually 100% successful in destroying all scale insects. While numerous releases of these beetles have been made in different parts of Puerto Rico, they appear to have widely dispersed on their own initiative, and the finding of these "Introduced Ladybeetles on Mona Island" (Jour. Ec. Ent., **37** (3): 451. Menasha, August 1944) is ample proof of the vigor with which they invade new environments. In December 1947, many were noted feeding on coconut scales at La Romana, Dominican Republic. At Kenscoff, Haiti, they are apparently responsible for the entire elimination of the West Indian peach

scale from peach trees, the earliest record of this ladybeetle from Haiti being from Jérémie in 1945.

The sharply differentiated, prominent yellowish lateral lobes of the dark blue prothorax and the shining dark blue elytra will identify **Curinus coeruleus** Mulsant, introduced into Puerto Rico from Martinique, French West Indies. It became established at Mayagüez and Bayamón by 1939, and has since been collected by Prof. J. A. Ramos at Río Piedras and at San Germán.

Egius platycephalus Mulsant, with shining yellow pronotum but dull black elytra so greatly produced laterally as to make the beetle appear broader than it is long, was introduced from Cuba. It has become established in the environs of Mayagüez, whence large-scale releases have been made in scale-infested bamboo at Loíza and Maunabo.

With the co-operation of Dr. Felisberto C. de Camargo at Campinas, Sao Paulo, Dr. K. A. Bartlett sent or had sent to Puerto Rico large numbers of **Exochomus orbiculus** Weise, and later received many **Exochomus jourdani** Mulsant from Brasil. Releases of both beetles were made at Mayagüez.

Cladis nitidula F. is a large, bright yellow ladybeetle, with head, eyes, middle of pronotum and elytra bright iridescent green. The larvae are white, yellow and black, spiny; the puparia orange-yellow marked with black, occurring singly or in clusters of three or four. Introductions of this ladybeetle were made from Trinidad and Martinique, and releases made at Mayagüez, in the expectation that they would be predaceous on bamboo scales. In April 1945, Mr. Francisco Seín found larvae and adults predaceous on *Orthezia praelonga* Douglas on bougainvillea vine at Río Piedras, and subsequently they were noted on gardenia bushes feeding on *Coccus viridis* Green and *Protopulvinaria longivalvulata* Green, eventually entirely freeing the bushes of these scales.

Dr. Francis X. Williams (1931–182) states that "if we first consider those ladybeetles that feed principally on plant-lice or aphids, we must place **Coleophora inaequalis** (Fabr.), an introduction from Australia in 1894, well at the head of the list, both as regards efficiency and abundance. It is a rather large, polished orange-red species, usually with heavy black markings, that measures about 5 millimeters or a fifth of an inch long. In Australia, it varies more in color and intensity of markings, one form being nearly all black". Many in Puerto Rico, descended from those brought from Hawaii, are mostly orange-red above with only the posterior half of the pronotum irregularly margined with black. "It is possible to rear a brood in 2 weeks' time, but the adults do not lay eggs until several days after hatching. Both larvae and adults devour aphids in great quantity, and they feed also upon the young of the sugarcane leafhopper, particularly

when the pest is numerous, and on other small creatures. *Coleophora*, however, is by no means confined to the agricultural districts, for we often find it on forest trees in the mountains, and in city gardens feeding on aphids on hibiscus". In 1938, a shipment of this Australian ladybeetle was received from Hawaii, and released in cane fields near Mayagüez, Cabo Rojo and Villalba, in the expectation that it would feed on *Sipha flava* Forbes, the yellow aphid of sugar-cane. Laboratory rearing and field releases were continued for some time, presumably firmly establishing it in Puerto Rico.

The most abundant of all the ladybeetles at present to be found in Puerto Rico is unquestionably the hemispherical **Cycloneda sanguinea** L., a medium-sized black species with the lateral margins of the pronotum and a spot on each side white, the entire elytra shining orange-red. Presumably it is endemic, Dr. Gundlach listing it as a *Neda*, and Dr. Stahl as a *Daulis*. Dr. Alex. Wetmore found that it had been eaten by the ani, tody, petchary, wood pewee, elainea, cliff swallow and a vireo. It was found to form part of the food of *Anolis gundlachi*, and presumably is also eaten by other lizards. It has most often been noted as predaceous on the yellow aphid of sugar-cane, *Sipha flava* Forbes, but it will eat any species of aphid on any host, anywhere in Puerto Rico. Dr. M. D. Leonard noted that it even feeds on the cottony cushion scale, and this observation has recently been confirmed by Mr. Francisco Seín. It occurs on Mona Island and in most of the West Indies, and in most South American countries, but has not been recorded from Vieques, Culebra and Desecheo. While scarcity of food in some cases may be the limiting factor in preventing it from becoming even more abundant, the Braconid wasp parasite, *Homalotylus terminalis* Say, which attacks the larva and causes the pupa to mummify, is the most obvious cause of its scarcity when food is present in abundance.

Procula ferruginea Olivier, previously assigned at various times in the genera *Neda*, *Cycloneda* and *Daulis*, is an even larger hemispherical endemic ladybeetle, entirely chestnut brown in color, except for black eyes. It is listed by Dr. Gundlach, and all earlier records are from coffee groves. Its presence in the mountains, however, is largely incidental, for it feeds largely or entirely on Psylliids, and in coffee groves it finds a great abundance of these on the tender shoots of the coffee shade tree *Inga vera*. In the forest of logwood, *Haematoxylon campechianum*, in the Guánica Insular Forest between Hda. María Antonia and the coast at Ballena, these beetles were noted exceptionally abundant, and sure enough, enormous numbers of the logwood Psylliid, *Heteropsylla fusca* Crawford, were present on the tender shoots of the trees.

Superficially resembling *Cycloneda sanguinea* in coloration, but longer

and narrower is **Coleomegilla innotata** Mulsant, listed by Drs. Stahl and Gundlach and in all the earlier local economic literature as a *Megilla*. It is not very abundant, and really is only a minor factor in the control of aphids, less often found on those of sugar-cane than on those of honey-dew melons, okra, beans and other garden vegetables. Mr. E. G. Smyth noted this beetle so often on hosts lacking aphids that he concluded they might also feed on pollen. Prof. J. A. Ramos states that these beetles are sometimes rather abundant on the aquatic vegetation of Cartagena and Guánica Lagoons, but possibly these plants are infested with *Rhopalosiphum nymphae* L., the waterlily aphid. It has plain, shining orange-red elytra, and is recorded only from Puerto Rico. The internationally common *Coleomegilla maculata* DeGeer has more pinkish elytra, spotted with black. It is not listed from Puerto Rico, but a live individual has been collected at the airport at Arecibo during wartime, to which it may accidentally have been carried in a plane from Cuba or continental United States.

Mr. R. H. Van Zwaluwenburg lists *Hippodamia convergens* Guérin-Méneville as predaceous on aphids at Mayagüez, where it had been introduced from California by Dr. C. W. Hooker in 1912, but it has not since been collected.

Dr. Felisberto C. de Camargo, Director of the Instituto Agronomico do Norte, at Belém do Pará, Brasil, when formerly at Campinas, Sao Paulo, made a special study of the Coccinellid genus *Psyllobora*, and has in preparation a monograph on the genus, which he is now much too busy to bring to completion. He claims that these little beetles feed only on the spores of rusts, and that one should search for them on plants the leaves or stems of which have been reddened by the breaking open of rust pustules. The little hemispherical yellowish **Psyllobora nana** Mulsant, with large black spots, has been taken at many points in Puerto Rico, resting on a great variety of hosts, but no collector has noted whether any of these showed rust spots.

Psyllobora lineola F. has much smaller black spots, and is a brighter yellow. Dr. Gundlach lists it, and subsequent collections have been made at Boquerón, Ponce, Guayama and on the Isle of the Caves in Laguna San José, between Pt. Cangrejos and Río Piedras. Prof. J. A. Ramos found both species quite abundant on Mona Island, on weeds, and the former also attracted to light.

Erotylidae: Pleasing Fungus Beetles

Under the light of the lighthouse at East Cape on Mona Island, on April 1, 1940, Dr. Luis F. Martorell collected four oval, dull black beetles, 5.0 mm. long, concerning which Mr. W. S. Fisher states that they belonged either to *Mycotretus* or *Tritoma*.

Some Erotylid beetles collected at Mayagüez by Prof. J. A. Ramos have been identified by Mr. W. S. Fisher as probably a species of *Hypodacne*.

Mycetophagidae: Hairy Fungus Beetles

Litargus balteatus LeConte, as identified by Mr. W. S. Fisher, was intercepted by Mr. R. G. Oakley on flowers of an undetermined plant near Ponce, and at Utuado what may be this species. Dr. Wetmore found a species of *Litargus* eaten by the northern parula warbler.

Typhaea semirufa Chevrolat is listed from Puerto Rico by Dr. Gundlach, but it has not since been collected here.

Typhaea stercorea L., (= *T. fumata* L.), a "narrowly oblong-oval, slightly convex, dull reddish brown beetle", 3.0 mm. long, "distributed by commerce to all parts of the world" according to Blatchley, in stored flour or grain, has been found in Puerto Rico in dry crotalaria pods at Pueblo Viejo, at light in Ponce, and Prof. J. A. Ramos reports collection on Mona Island.

Colydidae: Cylindrical Bark Beetles

Aulonium bidentatum F., listed by Dr. Gundlach, was found by Dr. Wetmore to have been eaten by a black and white warbler, which, in its habits of search for food resembles the nuthatches. He found that the black and white warbler had also eaten **Asynchita granulata** Say, listed by him as an *Endeitoma*, and later called a *Synchita:* "oblong, parallel, moderately convex; uniformly dull reddish brown, subopaque; elytra coarsely granulate, length 4.0 mm." and in life covered with a lavender bloom that is very noticeable on the insect in the field but seems to have disappeared completely from museum specimens. It is common under the bark of trees in the dryer portions of the Island, where it has been repeatedly collected, and has also been found on El Yunque, and at Aibonito in a tree fungus.

Cryptozoon civile and **Cryptozoon nitidicolle** were described from Puerto Rican type material by L. W. Schaufuss in his "Coleopteres aveugles de la Famille des Colydidae" (Ann. Soc. Ent. France, Ser. 6, **2:** 46–48. Paris, 1882), but neither has since been collected here or elsewhere.

Bitoma undata Guérin-Méneville was the determination of Mr. A. J. Mutchler for Dr. Stuart T. Danforth of a beetle which he had found under the bark of decaying trees of "almácigo" (*Bursera simaruba*) at Joyuda. It has since been collected under the bark of an unspecified tree at Añasco, but no subsequent collections have been made of the **Bitoma trifasciata** Moritz listed by Leng & Mutchler as a *Ditoma*, nor of **Eulachus semifuliginosus** Chevrolat and **Neotrichus tuberculatus** Chevrolat, also listed by them.

Lobogestoria gibbicollis Reitter, as determined by Mr. W. S. Fisher, has been intercepted in rotten wood at Adjuntas, and in rotten wood in the mountains north of Ponce by Mr. R. G. Oakley.

Pycnomerus exaratus Chevrolat is recorded from Puerto Rico by G. C. Champion in his "List of the Clavicorn Coleoptera of St. Vincent, Grenada and the Grenadines" (Trans. Ent. Soc. London for 1898, p. 401).

Pycnomerus biimpressus Reitter was the identification given by Mr. W. S. Fisher of some beetles collected under a dead tree at Matrullas Dam by Mr. R. G. Oakley, and at Mayagüez by Prof. J. A. Ramos.

Penthelispa aequicollis was described by Edm. Reitter as one of the "Neue Colydidae des Berliner Museums" (Deutsche Ent. Zeitschrift, **22** (1): 123. Berlin, 1878) from material collected in Puerto Rico, and it has been repeatedly intercepted since from decaying wood and tree fern fronds, *Cyathea arborea*, in the mountains.

One or more species of **Ethelema** occur in Puerto Rico, living on leaves of pomarrosa and coffee shade trees, or on dead leaves and debris on the ground at the higher elevations.

Bothrideres dentata Chevrolat, as identified by Mr. W. S. Fisher, was found under bark of beefwood (*Casuarina equisetifolia*) at Guánica, and under bark of dead tree in Guánica Forest by Prof. J. A. Ramos.

Philothermus puberulus, described by Dr. E. A. Schwarz (1878–361) from Florida, has been collected on El Yunque, and on decaying wood at Añasco.

Euxestus erithacus Chevrolat, first recorded from Puerto Rico by Albert Fauvel in his "Notes Synonymiques" (Rev. d'Entomologie, **14:** 106. Paris, 1895), considered "probably not more than a variety of *E. parki* Wollaston" by Leng & Mutchler, is indeed synonymous with *Olibrus parki*. Under this should presumably be grouped the records of species of *Olibrus* found by Dr. Alex. Wetmore to have been eaten by the northern parula warbler, and noted by Dr. M. D. Leonard as commonly found breeding in dry pods of pigeon peas at Río Piedras during July and August. These beetles were also repeatedly intercepted by Mr. R. G. Oakley: on fungus on a tree and on *Inga vera* at Aibonito; on orange leaves and on flowers of *Inga laurina* at Adjuntas; on leaves of "moca" (*Andira jamaicensis*) at Ponce, and on wild morning-glory at Juana Díaz.

Mordellidae: Tumbling Flower Beetles

The Mordellid beetles are small and wedge-shaped, characterized by Mr. W. S. Blatchley as "having the body arched, the head bent downward and the abdomen usually prolonged into a style or pointed process". "The name *Mordella*, that of the typical genus, is from the Latin *mordere*, or 'bite'." Herr G. Quedenfeldt, working on the material submitted by

Dr. Gundlach, described in "Neue und selterne Kafer von Portorico" (Berliner Entomologische Zeitschrift, **30** (1): 119–128. Berlin, 1886) four new species from Puerto Rico and identified two others. It remained for Mr. Eugene Ray, however, in his "Synopsis of the Puerto Rican Beetles of the Genus *Mordellistena*, with Descriptions of New Species" (Proc. U. S. National Museum, **84** (3020): 389–399, fig. 1, ref. 5. Washington, D. C. 1937) to describe ten additional endemic species, collected in almost equal numbers by Mr. R. G. Oakley, and by Mr. C. M. Matos, formerly one of the students of Dr. Stuart T. Danforth at Mayagüez, and now and for many years past, Agricultural Agent at Comerío.

Mordella basifulva Quedenfeldt and **Mordella leucocephala** Quedenfeldt have not been found in Puerto Rico since Dr. Gundlach collected the types here.

Mordella scutellaris F., first reported from Puerto Rico by Dr. Gundlach, has been repeatedly collected since: on milkweed flowers at Bayamón, on flowers of "margarita" (*Bidens pilosa*), "cundeamor" (*Momordica charantia*) and other plants at Arecibo; of "zarza" (*Senegalia westiana*) at Ponce. Others of this genus, not identified as to species, have been collected on coffee and "jagüey" (*Ficus laevigata*).

Mordellistena annuliventris Quedenfeldt, according to Ray (1937–390), is characterized with the "ventral surface bicolorous", and was most recently collected at Aibonito by Mr. R. G. Oakley, by Prof. J. A. Ramos at Mayagüez and Ponce, and also on Mona Island.

The type of **Mordellistena angustiformis** Ray (1937–390) was intercepted by Mr. R. G. Oakley at Indiera, in the mountains above Yauco, and Mr. C. M. Matos found others at Adjuntas.

The type of **Mordellistena barberi** Ray (1937–395) was intercepted by Mr. R. G. Oakley at Ponce on "moca" (*Andira jamaicensis*), others on coffee at Juana Díaz.

The type of **Mordellistena danforthi** Ray (1937–392) was from Villalba, collected by Mr. C. M. Matos.

The type of **Mordellistena ephippium** Ray (1937–398) was from Aibonito, other from Ponce, intercepted by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*).

Mordellistena ferruginea F. is listed as a continental species, but the only assured records are from St. Thomas and Puerto Rico. The early record by Dr. Gundlach has been confirmed by numerous later collections: on banana leaf at Ponce, on mamey leaf at Barceloneta, on *Inga laurina* at Juana Díaz, and possibly to it also should be assigned Dr. Wetmore's records (as sp.) of being eaten by the wood pewee, the redstart and the yellow warbler.

The type of **Mordellistena humeralis** Ray (1937–393), collected by

Mr. C. M. Matos, was from Villalba; that of **Mordellistena leai** Ray (1937–396) was collected by the grapefruit grower Capt. Lesne in his grove at Bayamón, other from Maricao.

Maricao is also the type locality for **Mordellistena lucidovirga** Ray (1937–398), collected by Dr. Harold Morrison, and others have since been found by Prof. J. A. Ramos at Mayagüez.

The type of **Mordellistena lineata** Ray (1937–395) was collected at Guánica by Mr. C. M. Matos, and this species has since been found on Mona Island by Prof. J. A. Ramos.

The presence in Puerto Rico of **Mordellistena marginicollis,** described from Brasil by F. W. Mäklin as one of his "Neue Mordelliden" (Acta. Soc. Sci. Fennicae, **10:** 561–595. 1875), is implied by inclusion in Ray's paper, where he differentiates it as having "elytra more than three times as long as broad". No recent collection has been made here.

Mordellistena signaticollis, described from Puerto Rico by Herr Quedenfeldt as a *Mordella,* is characterized, according to Ray, in possessing "basitarsus with two oblique ridges". No specimen has been collected since Dr. Gundlach's of the type.

The type of **Mordellistena varietas** Ray (1937–391) is from Adjuntas, others from Villalba and Maricao; that or **Mordellistena y-nigrum** Ray (1937–397) was intercepted by Mr. R. G. Oakley on *Inga laurina* at Juana Díaz.

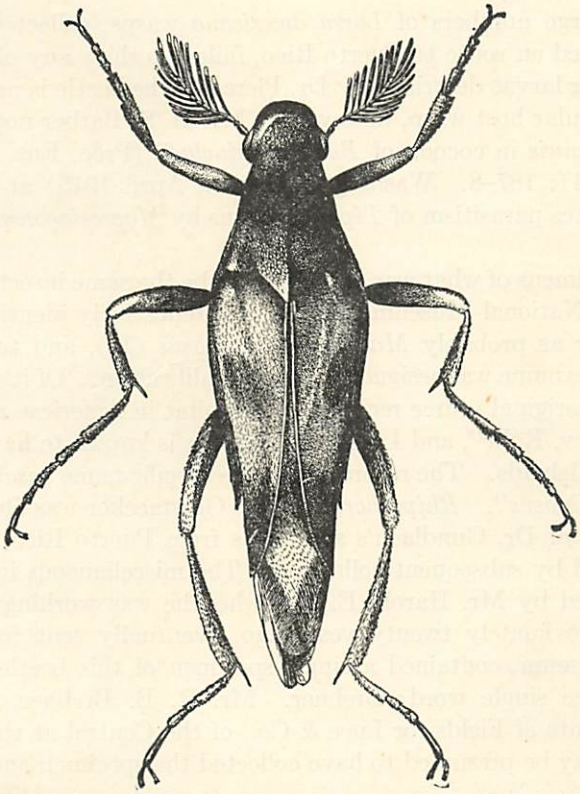
Mordellid beetles intercepted by Mr. R. G. Oakley on *Randia mitis* at Ponce were identified by Mr. H. S. Barber as a species of *Pentaria.* Mr. Eugene Ray identified some collected by Prof. J. A. Ramos at Mayagüez as being his **Pentaria multiplis,** previously known only from Cuba.

Naucles fasciata Ray (1939–312) was described from material collected at Ponce.

Rhipiphoridae

The Rhipiphorids are "wedge-shaped beetles resembling the Mordellidae closely in general appearance, but having the sides of the thorax without a sharp edge; hind body not terminating in a spinous process as in the Mordellids" according to Blatchley. Large and conspicuous Rhipiphorids are quite common on the flowers of "botoncillo" (*Borreria verticillata*) at Belém do Pará, Brasil, and when collections were being made there of the wasp *Larra americana* Saussure, in an attempt to introduce this natural enemy of the changa into Puerto Rico, some of these beetles were also collected, killed, pinned and mounted for the collection. One species, black with the anterior third of its elytra bright yellow, was identified by Mr. G. E. Bryant of the British Museum, as **Macrosiagon flavipennis** LeConte. In the list by Dr. R. E. Blackwelder (1945–480) it is given as

flavipenne LeC. 66–153, with a range from Mexico and the U. S. A., the United States records in Leng (p. 156) being "Pa. Ga. Ill. So. Cal. Conn." When intensive observations on botoncillo flowers, to note the dispersion of the introduced *Larra americana*, were commenced in Puerto Rico, what appears to be this species was found in considerable abundance in 1939 and 1940 at all points where releases of this wasp from Brasil had been



Adult of the Rhipiphorid Beetle, *Macrosiagon pectinatus* Fabricius, a parasite of continental *Tiphia*, eight times natural size. (After Davis.)

made, even including Luquillo, where it did not become established until years later. Specimens from Luquillo were sent to Dr. W. Dwight Pierce, a specialist in this group, concerning which he replied under date of September 30, 1941:

"The determination is correct. I have compared it with specimens from our central states and can find no distinguishing characters. It is a little of a puzzle as to whether this beetle has just recently come to Puerto Rico, or whether the collectors have merely failed to find it in

the past. Ordinarily these beetles are only found during the short season, and by rather specialized collecting at certain flowers and in the vicinity of the host nests. They undoubtedly lay their eggs in flowers and the young will hatch and cling to the legs or hairs on the body of host insects. If you will scrutinize your collections under the microscope, you may find some of these larvae clinging to the hairs of some of the wasps."

Search on large numbers of *Larra americana* wasps, collected in Brasil, which had died en route to Puerto Rico, failed to show any of the Rhipiphorid eggs or larvae described by Dr. Pierce. The beetle is not restricted to any particular host wasp, however, as Mr. H. S. Barber notes "*Macrosiagon flavipennis* in cocoon of *Bembex spinolae*" (Proc. Ent. Soc. Washington, **17** (4): 187–8. Washington, D. C., April 1915) at Brookland, D. C., and cites parasitism of *Tiphia* cocoons by *Macrosiagon pectinatus* F. in Illinois.

Other specimens of what was considered to be the same insect, submitted to the U. S. National Museum, were at first tentatively identified by Mr. H. S. Barber as probably *Macrosiagon spinosus* (F.), and to additional specimens this name was assigned without qualification. Of it, Mr. Barber writes, "The original source record was "Habitat in Americae meridionalis Insulis Dom. v. Rohr", and I believe von Rohr is known to have collected in the Virgin Islands. The record under the specific name *basalis* probably belongs to *spinosus*". *Rhipiphorus basalis* Gerstaecker was Quedenfeldt's identification of Dr. Gundlach's specimens from Puerto Rico, apparently not confirmed by subsequent collection. The miscellaneous insect collection assembled by Mr. Harold E. Box when he was working at Central Aguirre approximately twenty years ago, eventually sent to the U. S. National Museum, contained a single specimen of this beetle, unlabeled except for the single word: Brebner. Mr. R. B. Brebner, one of the Superintendents of Fields for Luce & Co., of the Central at the time Box was there, may be presumed to have collected the specimen and presented it to him.

If all these data are correct, we have a chain of evidence indicating (1) original collection in the Virgin Islands, (2) subsequent collection in Puerto Rico by Dr. Gundlach, and (3) later collection by Mr. Brebner for Mr. Harold E. Box. The apparent recent abundance is not real, and has no connection with the introduction of *Larra americana* from Brasil. But because of intensive observations on the insect visitors of botoncillo flowers, which these beetles haunt, many happened to be collected within a short period at many localities along the north coast of Puerto Rico. The beetles show considerable variation in both size and coloration, the largest

being half an inch long, and some have most of the elytra yellow. One individual has elytra entirely yellow, and reddish antennae.

Macrosiagon discicolle Gerstaecker is a much smaller beetle, of which three varieties: **mutilatus** Gerst., **melanoptera** Chevrolat and **quadrimaculatus** Gerst. are listed by Dr. Gundlach. The variety most common on botoncillo flowers is bright chestnut-red with black elytra. Another is entirely black, a third has only the posterior margin of the prothorax red, and the four-spotted one has been collected on seed pods of Jamaican sorrel at Bayamón.

Herr Quedenfeldt described (1886–128) as **major** a variety of *Rhipiphorus* (now **Macrosiagon**) **sordidum** Gerstaecker which Dr. Gundlach collected here.

Meloidae: Blister Beetles

Dr. E. A. Schwarz identified as a species of Zonitis the Meloid beetles which Mr. E. G. Smyth collected at light at Guánica in 1913. They are 11.0 mm. long, mostly dull yellow in color, median area of disc of prothorax and two large longitudinal bands on each elytron brown, and as they are apparently still unnamed, might appropriately be called **smythi.** Another **Zonitis,** of which a single specimen was collected at light at Guánica by Mr. E. G. Smyth on August 8, 1913, 16.0 mm. long, mostly dull yellow, but with areas of brown at base and near apex of the elytra, may be designated as **guanicana.**

Cissites maculata Swederus, identified by Dr. E. A. Schwarz as *Horia auriculata* Duges, from 15.0 to 20.0 mm. long, mostly orange-yellow, has two series of four black spots, to some extent tending to be confluent, on each elytron. It has been collected at Río Piedras, Mayagüez, Hormigueros and San Germán.

Epicauta annulicornis, described by Chevrolat (1877–ix) from specimens collected in Puerto Rico by Dr. Gundlach, has since been found only at Mayagüez, but of Chevrolat's **Epicauta obscuricornis,** described at the same time from Dr. Gundlach's material, no specimen has since been found.

Tetraonyx quadrimaculata F., found in many of the Lesser Antilles and the Virgin Islands, as well as in Cuba, Puerto Rico and the southern United States, was listed by Chevrolat, Drs. Stahl and Gundlach, and has been repeatedly collected since. It is mostly yellow, with black head and antennae, and with the legs black distad of the apex of the femora. Hardly more than the median third of each elytron is yellow, the black base and apex forming the four spots of the specific name. The beetles are possibly most often found on the flowers of leguminous plants in the more humid parts of the Island, but may occur on other kinds of flowers, as on flowers

"yerba bellaca" (*Croton humilis*) at Isabela, of *Lantana camara* at Trujillo Alto, and sometimes in such abundance as to cause appreciable injury, as on grapefruit blossoms at Bayamón, and on flowers of tecoma vine or "ricosolana" (*Pandorea ricasoliana*) at Isabela.

Stylopidae: Twisted winged Insects

Stenocranophilus quadratus, the Puerto Rican representative in a "Description of Two New Species of Strepsiptera (Halcotophagidae) Parasitic on Sugar Cane Insects" (Proc. Ent. Soc. Washington, **16** (3): 126–9. Washington, D. C., September 1914) by Dr. W. Dwight Pierce, was collected by Mr. Thos. H. Jones on October 14, 1912 at Río Piedras from the sugar-cane Fulgorid, *Delphax saccharivora* Westwood. A year later, additional material was obtained for study of the immature stages by Dr. Pierce, for this parasite is quite abundant, and is possibly one reason why its host is normally so scarce in Puerto Rican cane fields. Known only from Puerto Rico, outbreaks of its host, the sugar-cane "fly", have been of historic destructiveness in Barbados and Jamaica, presumably in part because this parasite is not present to minimize the abundance of the Fulgorid. The parasite will be noted extruding from between the abdominal segments of nymphs and adults of *Delphax*, but no attempt at working out its life-history has been made since the collection of the types by Mr. Jones.

Oedemeridae

Enormous numbers of restless, slender, iridescent blue-green or purplish Oedemerid beetles are sometimes to be found on beach vegetation, or attracted to lights in the spring, from April to June, on the north coast of Puerto Rico. Altho substantially similar in general appearance, they show considerable variation in size and color, and even in habits. Both the larger beetles with pinkish iridescence which dropped from bushes of seagrape at Pt. Salinas (the next point west of Palo Seco, fortified by the U. S. Army in World War II) when capture was attempted in June 1916, and the smaller greenish ones which flew when disturbed, were much more difficult to capture than those apparently feeding on the honey or pollen of the flowers of a *Metastelma* vine in the Condado in April of the same year, or those in May and June 1923 very abundant at Pt. Cangrejos resting on the stems, leaves and flowers of a common fleshy-leaved plant "jayajabico" (*Erithalis fruticosa*) with white, star-shaped flowers and purple berries. As these beetles are merely a nuisance when they swarm about lights of houses in the spring, no economic study of them has been made, and nothing is known of their immature stages. None of them answering to Chevrolat's

description of *Oxacis geniculata* from Puerto Rico, according to Mr. H. S. Barber, they were described in "Insectae Borinquenses" (1936–206) under the specific name of *litoris*. Prof. J. A. Ramos thinks that this description agrees perfectly with a single specimen which he collected on Mona Island in March 1944, listed by him (1947–37) under the name **Copidita (Asclera) litoris** Wolcott.

Copidita laeta Waterhouse, identified by Mr. J. M. Valentine as an *Oxacis* for Prof. J. A. Ramos of specimens collected at Guánica and Faro de Cabo Rojo, is listed by Dr. R. E. Blackwelder (1945–490) from Mustique, Grenada, Jamaica and Hispaniola.

Copidita lateralis Waterhouse, as doubtfully identified by Mr. H. S. Barber for material intercepted at San Juan and Bayamón, is the name given without qualification by Mr. J. M. Valentine to Oedemerids collected by Prof. J. A. Ramos at Mayagüez.

Copidita rubricollis, described by Charles O. Waterhouse (1878–309) from St. Thomas, and **Copidita tenella** Waterhouse, subsequently listed from St. Vincent, Jamaica and Hispaniola, should also occur on Culebra and Vieques, even if not in Puerto Rico itself.

A single Oedemerid, entirely dull violet-blue in color, collected on Sardinera beach, Mona Island, July 20, 1944, Prof. J. A. Ramos (1947–37) lists as a species of **Copidita (Asclera),** as determined by Mr. J. M. Valentine.

Others of this genus, as described by Mr. Valentine, are readily distinguished "with the prothorax brownish red, the eyes and antennae nearly black; the elytra with outer margins and a median longitudinal ridge whitish", first found by Dr. Stuart T. Danforth as very abundant on Desecheo Island on May 8, 1927, and determined by Mr. A. J. Mutchler as a new species of *Ditylus*. Because of this first collection, it might be well to designate these beetles as **Copidita (Asclera) desecheonis.** Prof. J. A. Ramos found one on Mona Island in June, and abundantly on weeds on the plateau in August 1944, and has in the collection many collected at Guánica in late July 1934 by Mr. C. M. Matos. The pubescent elytra of some are purplish, others are blue-green or horizon blue in color.

Oxacis geniculata, described by Chevrolat (1877–x) from Puerto Rican material collected by Dr. Gundlach, is listed by Drs. Gundlach and Stahl. As this species, Mr. J. M. Valentine identifies numerous specimens collected by Prof. J. A. Ramos on Mona Island in March and April, but the only specimen in the collection at Río Piedras corresponding to this abundant Mona Island material is a single specimen found by Mr. Francisco Seín at light in Santurce, April 10, 1922. In August 1939, Dr. Luis F. Martorell found these beetles very abundant on seagrape bushes on Mona

Island in the daytime, and swarming about lights at night. "This is the second most abundant and the largest Oedemerid on the Island. The head, except for the black eyes and infuscated basal segment of the antennae, and the entire prothorax are yellowish. The abdomen and elytra, except the outer and inner margins, are greyish-blue. The legs are light yellow, with the apical half of the femora strongly infuscated" according to Prof. Ramos (1947–38).

Sessinia vittata F., until quite recently called *Ananca*, was collected in Puerto Rico by Dr. Gundlach and listed by Chevrolat (1877–x), and by Leng & Mutchler from Vieques. Dr. Stuart T. Danforth subsequently collected it on Vieques, as well as from Humacao, Yauco, Faro de Cabo Rojo, Mayagüez and Añasco, and collections have also been made at Isabela, and at Pt. Cangrejos and Santurce on the north coast. It was especially abundant and troublesome at Aguirre in May 1916, and again in June 1923, as reported by Mr. F. S. Earle, forcing its way thru screens and around glass windows into houses at night. Mr. E. G. Smyth noted many attracted to light at Hda. Santa Rita, Guánica in July and August 1913. Superficially, it looks like a somewhat faded and browned specimen of *Oxacis geniculata*, for in life the elytra are often blue-grey, sometimes with only a narrow median band between very broad margins, but the legs are invariably entirely yellowish. Prof. J. A. Ramos (1947–38) personally collected a single specimen on Sardinera beach on Mona Island in April 1944.

Short descriptions of three distinctly different species of **Alloxacis,** as identified by Mr. J. M. Valentine, collected only on Mona Island, are given by Prof. J. A. Ramos (1947–38). The most abundant in the spring, "a very dull and dark blue species", was found feeding on the pollen of the flowers of "abeyuelo", *Colubrina ferruginosa.*

Scraptiidae

Cteniacantha marginata, described (1886–121) by Herr G. Quedenfeldt from Puerto Rican material collected by Dr. Gundlach and listed by him, has since been intercepted in the mountains north of Ponce and at Adjuntas by Mr. R. G. Oakley. Other interceptions in the mountains have been identified by Dr. E. A. Chapin as species of **Scraptia** and **Conomorphus,** and on mangrove at Guánica as **Canifa.**

Monommidae

Hyporrhagus marginatus F., as a *Monomma*, is reported from Puerto Rico by both Dr. Stahl and Dr. Gundlach, but of it no subsequent collection has been made.

Aspathines aenea Thomas, as identified by Dr. E. A. Chapin, has been

found on dead wood at Guayanilla and on mangrove at Ponce by Mr. R. G. Oakley.

Alleculidae (Cistelidae): Comb-Clawed Bark Beetles

Enormous numbers of elongate-oval brown beetles with golden pubescence, 5.0 to 6.0 mm. long, are sometimes to be found under dry seaweed and dead vegetation on the beach, or at night are attracted to lights in houses near the beach. They have been found hiding under the loose bark of lignum-vitae or "guayacán" (*Guaiacum officinale*) and of snake-bark or "abeyuelo" (*Colubrina ferruginosa*) at Guánica, and Mr. R. G. Oakley found them repeatedly at Ponce, on "ucar" (*Bucida buceras*) and other trees. Possibly their most interesting hiding place, beside the squares and bolls of cotton, is in the empty pupal skins of the cotton caterpillar, *Alabama argillacea* Hübner, observed at Hatillo. At Pt. Cangrejos, they were noted hiding in cavities in the stems of dead or injured castor bean plants, and in an investigation to determine the number of animals present in three square feet of pasture near the beach (in February 1920, before all this region had been so closely built up as to form a suburb of Santurce), seven of these beetles were found. Quantitatively, this indicates their abundance at particular times, not their entire absence at other times. They are eaten by the iguana, *Ameiva exsul*, but Dr. Wetmore noted none in the stomach contents of any of the beach-inhabiting birds that he collected. Two observations, in February and June, have been made of their exceptional abundance on "malvavisco", *Corchorus hirsutus*, at Pt. Cangrejos, and in September on Mona Island, in a few of these plants on the edge of the air-strip near the beach where two or three beetles were hiding in the folds of nearly every leaf, or in the terminal buds. They were merely resting, not feeding, and indeed little is known of their habits or immature stages, for they are definitely of no economic importance, having never been noted injuring any economic plant, or any other. In August 1939, Dr. Luis F. Martorell found them very abundant on a weed locally known on Mona Island as "té", and they have been collected at light on Mona in March, April, June, July and September. Concerning their identity, Dr. Gundlach lists *Allecula flavipes* J. Duval in synonymy with *Allecula fuscula* Schönherr, the latter name only being given by Quedenfeldt. Some of the specimens from Pt. Cangrejos were identified by Dr. E. A. Schwarz as a species of **Hymenorus,** and Mr. K. G. Blair of the British Museum tentatively gave the name *Hymenorus fuscula*. Mr. A. J. Mutchler labeled one specimen *Hymenorus fuscula*? Fab., but Dr. E. A. Chapin called the recent collections from Mona probably a new species of *Hymenorus*. If a specific name is needed for the Mona Island-Puerto Rican species, it might well be **corchorophilus.**

Tenebrionidae: Darkling Beetles

Treintoma varvasi Solier, as determined by Dr. C. W. Leng, was collected by Dr. Stuart T. Danforth at Ensenada in February 1927, and by students of his at Guánica in April 1931. On Mona Island, Prof. J. A. Ramos reports (1947–39) sweeping specimens from vegetation on Uvero beach in July and August, 1944.

Diastolinus fuscicornis, described by Chevrolat (Ann. Soc. Ent. France, (5), VII Bulletin, p. viii. Paris, 1877) from material collected by Dr. Gundlach, has not since been found.

Opatrinus pullus Sahlberg (=*anthracinus* Mulsant), first determined by Dr. E. A. Schwarz as *Hopatrinus*, from specimens collected at the base of decaying pineapple slip, is a shining black beetle 10.0 mm. long, with deeply punctate elytra and minutely and evenly punctate head and pronotum. It has since been collected by Dr. Stuart T. Danforth or his students at Ensenada, Mayagüez, Añasco, Coamo and Tortuguero, and most recently at light on Mona Island by Dr. Luis F. Martorell.

Blapstinus punctatus F., as determined by Mr. A. J. Mutchler, is a dull black beetle, 5.0 mm. long, which Dr. Stuart T. Danforth reported as doing considerable damage to tobacco seedlings and melons at Algarrobo in February 1931. This is the only record of attack on cultivated crops, however, despite periods of temporary abundance of these beetles, especially in the more xerophytic parts of Puerto Rico. In Tablón No. 9, Hda. Santa Rita, Guánica, in December 1914 they were so numerous that whenever an old stool of cane was broken up, dozens would scurry for cover. The smallest piece of trash or chunk of dirt seemed to offer them all the concealment necessary. At Boquerón they have been found in like abundance hiding under every slab of dry cow dung, where the hard unbroken crust of dry soil offered no other chance at concealment. Dr. Stuart T. Danforth and/or his students have also collected these beetles at La Plata, Faro de Cabo Rojo, Tortuguero, Humacao and Luquillo, Mr. R. G. Oakley found them at Jayuya, and Dr. Luis F. Martorell first noted them at light on Mona Island.

Blapstinus striatulus Melsheimer, as tentatively identified by Dr. E. A. Chapin, are similarly dull black beetles, reported as attacking sprouting cotton seedlings at Isabela in June 1931.

Sellio tibidens Quedenfeldt, as tentatively identified by Mr. K. G. Blair of the British Museum, is 6.0 to 7.0 mm. long, with elytra decidedly constricted just distad of the base, and broadest at the middle. They were found abundant under dry cow dung at Boquerón and at Salinas in the summer of 1923. Dr. Stuart T. Danforth had specimens from Desecheo Island. When alive they have a noticeable bluish bloom which is not apparent in the museum specimens.

Trachyscelis flavipes Melsheimer, as tentatively identified by Mr. K. G. Blair, is a small black beetle, hairy beneath, found on the beach at Pt. Cangrejos in January 1923. Other individuals, collected by Dr. Stuart T. Danforth at Río Piedras in August 1931, were considered a new species by Dr. E. A. Chapin.

Concerning **Phaleria variabilis,** described by G. Quedenfeldt (1886–128) from Dr. Gundlach's material from Puerto Rico, Gundlach says in his list: "esta especie varía mucho en su colorido que puede ser totalmente el pálido amarillo hasta casi el solo negro, o amarillo con una mancha común oscura en forma de luna sobre el disco de los elitros". Dr. E. A. Chapin identified as this species the beetles and larvae found in the claws of dead crabs on the beach at Isabela, and tentatively some adults at light on Mona Island, Mr. A. J. Mutchler adults found under seaweed on the beach at Pt. Cangrejos, and Dr. A. G. Böving those under seaweed at Cataño and Santurce. Previously, specimens showing the same variation in coloration, collected under seaweed at Pt. Cangrejos, were identified by Dr. E. A. Schwarz as **Phaleria angustata** Chevrolat, described by him in 1878, and Dr. R. E. Blackwelder thus identified the material collected by Prof. J. A. Ramos on Mona Island. It seems possible that both names apply to the same, very variable insect.

Dr. Wetmore reports finding in the stomach contents of the killdeer beetles identified as a species of **Crypticus,** and Dr. E. A. Schwarz gave this name, "possibly **obsoletus** Say" to others of these dull black beetles, 3.0 to 4.0 mm. long, collected on seaweed on the beach at Pt. Cangrejos, and to 13 such beetles found there in three square feet of pasture. They have since been found in a pasture at Camuy, and by Prof. J. A. Ramos at Hatillo and Mayagüez, and on Mona Island.

Eutomus cornutus Arrow, as determined by Dr. E. A. Chapin, has been found in a tree fungus at Mayagüez.

Eutomus micrographus Lacordaire, determined by Dr. E. A. Schwarz as a *Rhipidandrus*, is a dull black beetle, 4.0 mm. long, of which many adults and larvae were found in a polypore fungus, *Fomes australis*, at Jájome Alto and at Adjuntas.

Diaperis hydni Fabricius, now less happily called *maculata* Olivier, is the other common beetle feeding on polypore shelf fungi in Puerto Rico and on Mona Island. Adults are broad, 5.0 to 7.0 mm. long, with basal half of the elytra chestnut red in color. This species was listed by Drs. Stahl and Gundlach, and has repeatedly been collected since, the most recent identification of the fungus being of *Polyporus palmarum* on coconut palm.

Beetles found in a polypore fungus on El Yunque have been identified by Dr. E. A. Chapin as belonging in a "genus near *Pentaphyllus*".

Palembus ocularis Casey, a light yellow-brown beetle, 4.0 mm. long, and its larvae have been found feeding on tamarind seeds, intercepted at Loíza, and noted on this host by Prof. J. A. Ramos at Faro de Cabo Rojo, but the original determination by Dr. E. A. Schwarz was of an individual collected on the ground at Pt. Cangrejos. Mr. R. G. Oakley also found these beetles on sedges at Ponce and at Cabo Rojo.

Of the numerous species of **Platydema,** Dr. Gundlach lists **apicalis** Laporte & Brullé, not since collected, and **picicornis** Fabricius, later found by Dr. Donald DeLeon under the bark of almácigo logs at Guánica. To numerous small black oval beetles found in dead almácigo (*Bursera simaruba*) infested by the termite *Nasutitermes costalis* Holmgren at Vega Baja, Mr. G. E. Bryant gave the name **Platydema excavata** Say, and Mr. J. A. Mutchler independently also made the same determination. Dr. Alex. Wetmore lists **Platydema virens** Laporte & Brullé as having been eaten by the black and white warbler, and this or other species by the woodpecker, oriole and grasshopper sparrow.

Numerous small beetles intercepted by Mr. R. G. Oakley in decaying tree fern (*Cyathea arborea*) or in decaying wood at Adjuntas, Villalba and in the mountains above Yauco at Indiera, have been identified by Dr. E. A. Chapin as a species of **Dioedus.**

Gnathocerus cornutus F., as identified by Mr. H. S. Barber, has been found in a tree fungus at Aibonito.

Gnathocerus maxillosus F., as identified by Dr. R. E. Blackwelder, was found at Guánica under the bark of almácigo trees by Dr. Donald De Leon, and under the bark of leguminous trees in the patio of the School of Tropical Medicine by Dr. W. A. Hoffman.

Tribolium castaneum Herbert (= *T. ferrugineum* Dej.), a dark reddish, elongate, flattened beetle, commonly known as an economic pest of flour, bran and similar stored products, was found by Dr. W. A. Hoffman under the bark of a leguminous tree in the patio of the School of Tropical Medicine. In Puerto Rico, this beetle has been found in dry peas, dry ganduls, chicory beans, dry tamarind pods at Guánica, dry cotten seed meal in a tobacco warehouse at Cayey, and most recently in the cotton ginnery at Isabela in which baled cotton and cotton seed in guano palm sacks from Hispaniola was stored. Together with the quite similar **Tribolium confusum** DuVal, also found in Puerto Rico, attacking similar dried food products, these two cosmopolitan pests may cause very considerable injury if allowed to breed undisturbed. Flour in tough paper sacks is much less readily infested than in cloth sacks, while that brought to the Island in bulk is most subject to injury. While fumigation is possible, most wholesale grocers and bakers anticipate only small shipments of flour at any one time, and plan to get rid of any infested flour quickly before they suffer much loss. Indeed,

the simplest and cheapest and most practical method of control in the tropics is prompt consumption by human beings of the food product.

First noted in Puerto Rico by Dr. Richard T. Cotton in wheat flour, is what he describes in his "Insect Pests of Stored Grain and Grain Products" (pp. 242, illus. Minneapolis, 1941) as a "cosmopolitan insect found in damp situations breeding in grain and cereal products that are spoiled or out of condition: the lesser meal worm, **Alphitobius diaperinus** Panzer. It causes no damage to grain that is sound and dry. The adult is black, or a very dark reddish brown, and measures from three to four-sixteenths of an inch in length. The larva is yellowish brown and similar in appearance to young larvae of the true meal worm".

"The black fungus beetle, **Alphitobius piceus** Olivier, is closely related to the lesser meal worm, . . . and has similar habits. In the lesser meal worm, the surface of the thorax is finely and sparsely punctuated, whereas in the black fungus beetle the surface of the thorax is coarsely and profusely punctuated". Of it in Puerto Rico, as *Heterophaga fagi* Panzer, Dr. Gundlach writes, "encontrado en almacenes y en lugares donde existen substancias descompuestas y secas". It has most recently been found in the cotton ginnery at Isabela, and Prof. J. A. Ramos noted it in a store-room for cattle feed at Mayagüez.

Sitophagus hololeptoides Castelnau, listed by Dr. Gundlach under Chevrolat's MS name of *Adelina livida*, has been recently collected at Mayagüez, and at Añasco by Prof. J. A. Ramos.

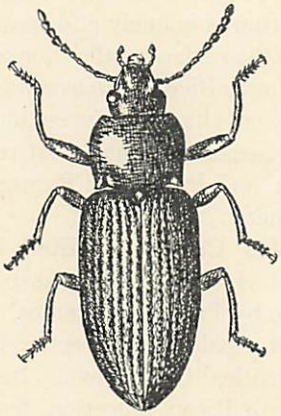
Doliema pallida Say, is a pale yellow beetle, 4.0 mm. long, so flat that it appears to have been crushed from above. Its head is concave between the eyes. The first Puerto Rican collection, from under bark of a fence post at Boquerón, was determined by Mr. K. G. Blair of the British Museum, but numerous subsequent collections have been made from similar xerophtic localities: under bark of almácigo at Guánica, and on stump at Ponce, the most recent being from Mona Island, where repeated collections from under loose bark of fence posts would indicate it as being quite common.

Corticeus rufipes F., identified as a *Hypophloeus* by Dr. E. A. Schwarz from material collected under bark of dead "bucare" (*Erythrina poeppigiana*) trees at Cayey by Dr. Richard T. Cotton, is a very elongate, cylindrical, shining brown beetle, since found under bark of dead flamboyán (*Delonix regia*) at Río Piedras, in dry branches of "burro" (*Capparis flexuosa*) at Santa Isabel, and at Mayagüez.

Zophobas morio F. is by far the largest Tenebrionid beetle occurring in Puerto Rico, adults being from three-fourths to seven-eighths of an inch long, entirely dull black or faintly bluish in color. Of it, Dr. Gundlach states, "se encuentra en las casas debajo de tablas, cajones, etc. Nunca

lo he visto en el campo". Leng & Mutchler list it from Culebra Island. *Zophobas rugipes* Kirsch is the determination by Mr. A. J. Mutchler of specimens from the Corozal cave, and from many other localities collected by Dr. Stuart T. Danforth and his students, but he was unable to note any distinguishing characteristics separating it from the other species. Records of collection are from all parts of Puerto Rico. The beetles are eaten by the introduced toad, *Bufo marinus*, and by the endemic iguana, *Ameiva exsul*. Nothing is known of the immature stages.

Dr. Richard T. Cotton may be quoted on the two species of meal worms which occur in Puerto Rico: "the yellow meal worm, **Tenebrio molitor** L., which was described by Linne in 1758 and the dark meal worm, **Tenebrio obscurus** F., which was described by Fabricius in 1792. The yellow meal



The Tenebrionid Beetle, *Zophobas morio* Fabricius, twice natural size. (Drawn by Fritz Maximilien.)

worm is so named because of its honey-yellow color. It is also known as the European meal worm because of the many reports of its occurrence in Europe. The meal worms are inclined by nature to be scavengers, and prefer to feed on decaying grain or milled cereals that are damp and in poor condition. They are usually found in dark, damp places". None was collected by Dr. Cotton while he was here, but Dr. Stuart T. Danforth and students have made innumerable collections at Mayagüez and at other localities in the western end of the Island, including, surprisingly enough, one of *T. molitor* on Desecheo Island. The adults are "elongate, narrowly oval, piceous or dark reddish-brown, opaque, 13.0 to 17.0 mm. long", and in that stage the two species are almost indistinguishable.

Mr. R. G. Oakley intercepted at Yauco some beetles identified by Dr. E. A. Chapin as a species of **Lorelopsis.** The only West Indian species of

this genus is *Lorelopsis pilosa*, described by G. C. Champion from St. Vincent.

Dr. Alex Wetmore reports the woodpecker, flycatcher, wood pewee, vireos, warblers and the oriole as eating beetles identified for him as a species of **Helops**, but no previous or subsequent collections by entomologists have been made that correlate with what he found so abundantly in these birds' stomachs.

Pyanisia tristis Laporte, reported as a *Cymatothes* by Drs. Stahl and Gundlach, has not since been found locally.

Strongylium pulvinatum was described from Puerto Rico by F. W. Mäklin (Acta. Soc. Sci. Fennicae, 8 (1): 265) in 1867, and Dr. Wetmore reports finding a beetle of this genus in the stomach contents of Latimer's vireo.

Talanus insularis Mäklin is doubtfully reported from Puerto Rico in the list of Dr. R. H. Blackwelder (1945–543).

Cisidae

Mr. R. G. Oakley intercepted on dead tree at Ponce, in decaying wood at Añasco and in fungus at Mayagüez what Mr. W. S. Fisher identified as species of **Cis.**

Ennearthron delicatulum J. DuVal, listed by Dr. Gundlach, is represented in a recent collection of a beetle of this genus in decaying wood at Añasco.

Prof. J. A. Ramos found abundant on fungi on Sardinera beach, Mona Island, what Mr. W. S. Fisher identified as a species of **Ceracis.**

Cerambycidae: Long-Horned Wood-Boring Beetles

Parandra cribrata Thomson and **Parandra cubaecola** Chevrolat, both re-reported from Puerto Rico by Leng & Mutchler, are possibly the least typical of the Cerambycidae. Only the first is represented by recent collections: at Villalba by Mr. R. G. Oakley, and on the floor of the camp at El Verde, in the Luquillo Mountains above Río Grande. These shining, parallel-sided, reddish-brown beetles, three-quarters of an inch long, have antennae inserted at the side of the head near the base of the mandibles barely reaching to base of the thorax. Dr. Alex. Wetmore reported the remains of one of these beetles in the stomach contents of an owl, and their occurrence is presumably confined to the higher forests.

With the jaws of the males three-quarters of an inch long, and total length approaching three inches, some species of *Stenodontes* (*Mallodon* or *Nothopleurus*) are among the largest beetles occurring in Puerto Rico, altho they are only three-quarters of an inch wide, and not nearly so thick and solid as the rhinoceros beetles. The females have much smaller man-

dibles, but more deeply serrate and more extended lateral margins of the prothorax. All are shining light brown. They are not abundant, and the only definite host record is of an adult in an oval tunnel in a live guácima (*Guazuma ulmifolia*) at Salinas, altho others have been found on dead stumps, or resting on trunks of dead trees on the ground. Mr. W. S. Fisher identified as **Stenodontes bituberculata** Palisot de Beauvois some unlabeled specimens, presumably collected at Guánica, the Danforth collection contains others from Mayagüez and Añasco, and Dr. Luis F. Martorell found one on Mona Island, resting on an old stump of a tree at Rancho Grande.

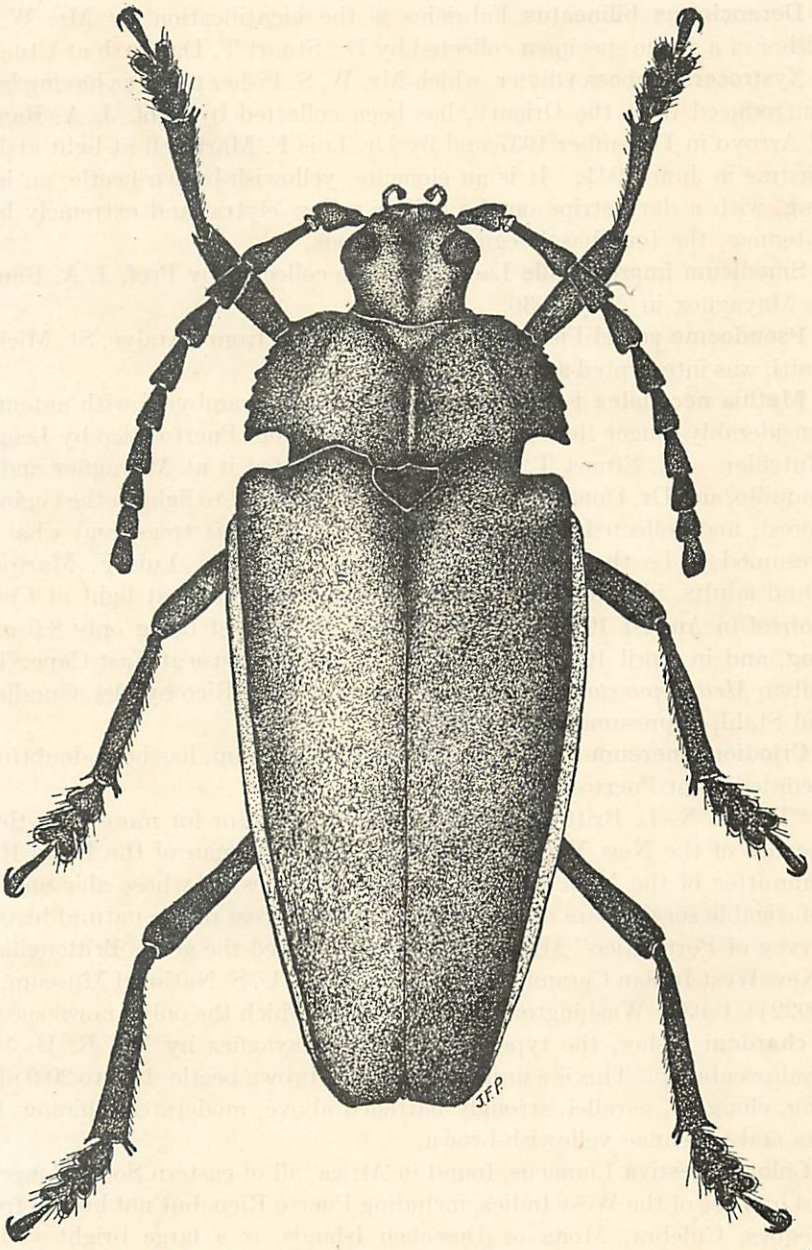
Stenodontes exserta Olivier, as identified by Mr. W. S. Fisher, is represented in the Río Piedras collection by one taken at light at Ceiba. This is what Drs. Stahl and Gundlach report as *Stenodontes mandibularis* F., known also from Mona Island.

Stenodontes maxillosus Drury, listed as a *Mallodon* by Drs. Stahl and Gundlach, is unrepresented in recent collections, and in doubt is the record of the subspecies *bajulus* Erichson of *Stenodontes dasystomus* Say, and Dr. Stahl's of *Stenodontes damicornis* Linnaeus.

Callipogon proletarium described, as a *Callomegas* by A. Lameere (Ann. Soc. Ent. Belgique, **48:** 66. Brussels, 1904) from Puerto Rico, is an even larger beetle, represented in recent collections by one found on stump at Lares, September 8, 1921, as identified by Dr. E. A. Schwarz.

Callipogon sericeum Olivier, listed as an *Orthomegas* by Drs. Stahl and Gundlach, is represented in recent collections by a male with curved and deeply sculptured jaws found by Mr. R. W. Johnson at Mayagüez. The specific name is most appropriate, as the beetle has a grey, mouldy appearance, due to the uneven, scattering silvery pubescence.

Derancistrus thomae Linnaeus, listed for Puerto Rico by Dr. Stahl as *Solenoptera lateralis* Chevrolat, and by Dr. Gundlach as a *Prosternodes*, is a comparatively common elongate, reddish-brown Cerambycid, varying in length from an inch and three-eighths to only five-eighths of an inch for the smallest individuals. It has prominent antennae, extending half way down the elytra margined with yellow. Dr. Alex. Wetmore reports it eaten by the kingbird, and Dr. Stuart T. Danforth by the lizard cuckoo. It has been collected in all parts of the Island, and abundant larvae found under the bark of fence posts or rotten stumps have been repeatedly reared to adult. Presumably any kind of unbarked dead or rotting wood will serve, those identified being "cedro" (*Cedrela mexicana*) at El Verde, "achiote" (*Bixa orellana*) at Lares, and "camasey" (*Henrietella fascicularis*) at Aguas Buenas, besides many others not recognized. From the incomplete rearing records, one may approximate the larval period as two months, that of the pupa as two weeks.



The Cerambycid Beetle, *Derancistrus thomae* Linnaeus, four times natural size. (Drawn by José F. Pietri.)

Derancistrus bilineatus Fabricius is the identification by Mr. W. S. Fisher of a single specimen collected by Dr. Stuart T. Danforth at Utuado.

Xystrocera globosa Olivier, which Mr. W. S. Fisher notes as having been "introduced from the Orient", has been collected by Prof. J. A. Ramos at Arroyo in December 1937 and by Dr. Luis F. Martorell at light at Río Piedras in June 1941. It is an elongate, yellowish-brown beetle, an inch long, with a dark stripe on the lighter yellow elytra, and extremely long antennae, the four basal segments scabrous.

Smodicum impressicolle Lacordaire was collected by Prof. J. A. Ramos at Mayagüez in May 1936.

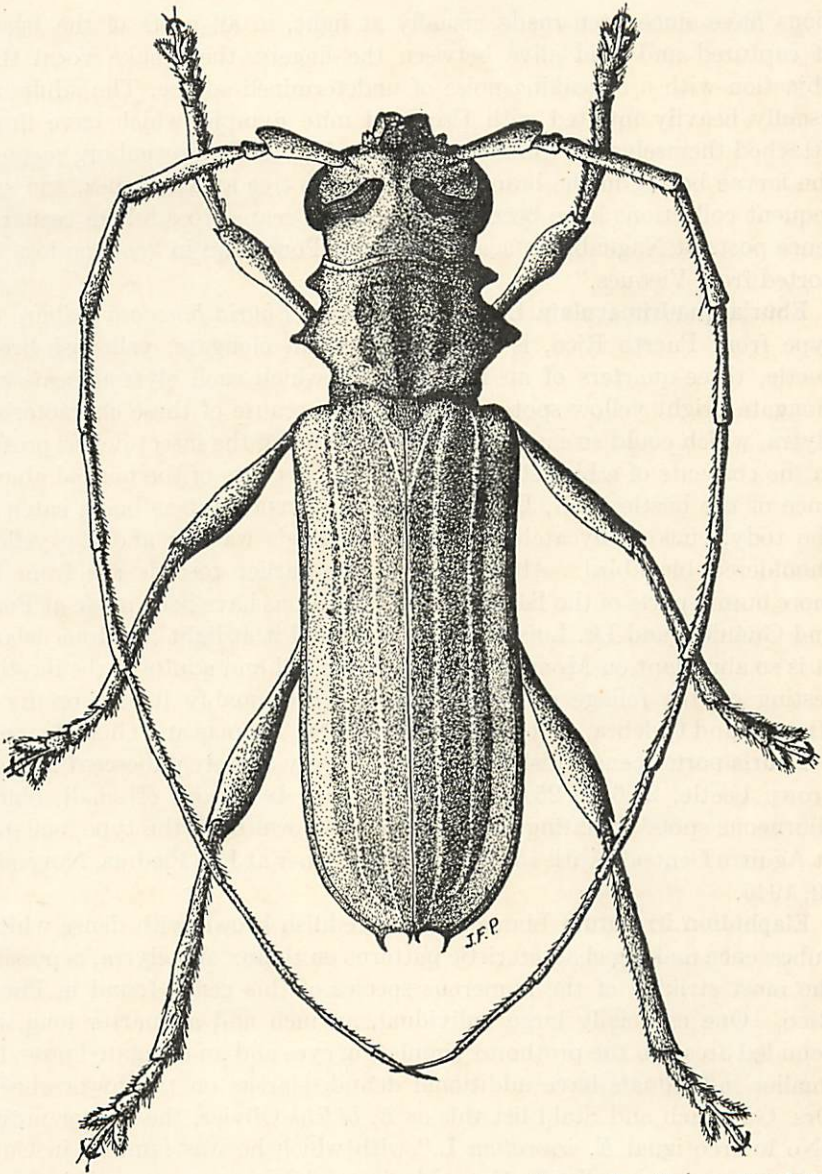
Pseudoeme poolei Fisher, originally described from l'Atalye, St. Michel, Haiti, was intercepted at light at San Juan.

Methia necydalea Fabricius, a slender little Cerambycid with antennae considerably longer than its body, was listed from Puerto Rico by Leng & Mutchler. Dr. Stuart T. Danforth had collected it at Mayagüez and at Luquillo, and Dr. Donald De Leon found it attracted to light in the Guánica Forest, and collected adults on *Eugenia* and *Amyris* trees, and what he presumed to be the larvae in their dead twigs. Dr. Luis F. Martorell found adults, identified by Mr. W. S. Fisher, common at light at Camp Kofresí in August 1939, on Mona Island, the largest being only 8.0 mm. long, and in April 1940 found others at the lighthouse at East Cape. The Cuban *Methia punctata* Leconte, listed from Puerto Rico by Drs. Gundlach and Stahl, is presumably this species.

Criodion cinereum Olivier, described from Surinam, has been doubtfully recorded from Puerto Rico.

"To Dr. N. L. Britton, eminent botanist, director for more than three decades of the New York Botanical Garden, chairman of the Porto Rico committee of the New York Academy of Sciences, to whose able and indefatigable services are due in large part the success of the natural history survey of Porto Rico" Mr. W. S. Fisher dedicated the genus **Brittonella** in "New West Indian Cerambycid Beetles" (Proc. U. S. National Museum, **80** (2922): 1–93. Washington, D. C., 1932), of which the only known species is **chardoni** Fisher, the types collected at Mayagüez by Mr. R. H. Van Zwaluwenburg. This is a uniformly reddish-brown beetle, 17.0 to 20.0 mm. long, elongate, parallel, strongly flattened above, moderately shining, the legs and antennae yellowish-brown.

Chlorida festiva Linnaeus, found in Africa, all of eastern South America and in most of the West Indies, including Puerto Rico, but not known from Vieques, Culebra, Mona or Desecheo Islands, is a large bright yellow Cerambycid, often an inch long, with elytra mostly light green in color. The apex of each elytron bears two spines, and the lateral margins of the prothorax have less pronounced spines. Above, the prothorax bears the



The Cerambycid Beetle, *Chlorida festiva* Linnaeus, four or five times natural size. (Drawn by José F. Pietri.)

darkened marking of a three-branched candelabra. The dark antennae are considerably longer than the body. Listed by Drs. Gundlach and Stahl, Dr. Alex. Wetmore found it eaten by the ani. Innumerable collec-

tions have since been made, usually at light, in all parts of the Island. If captured and held alive between the fingers, they make vocal their objection with a squeaking noise of undetermined source. The adults are usually heavily infested with Uropodid mite nymphs which have firmly attached themselves to the thorax. Mr. R. H. Van Zwaluwenburg recorded the larvae boring in the branches of a mango tree at Mayagüez, and subsequent collections have been made of larvae reared to adult in casuarina fence posts at Naguabo, in acacia stump at Ponce and in "cobana logs imported from Vieques."

Eburia quadrimaculata Linnaeus, of which *Eburia binodosa* Gahan, the type from Puerto Rico, is a synonym, is an elongate, yellowish-brown beetle, three-quarters of an inch long, of which each elytron bears two elongate bright yellow spots. Presumably because of these characteristic elytra, which could so easily be recognized among the insect debris present in the contents of a bird stomach, as well as because of the normal abundance of the beetle itself, Dr. Alex. Wetmore reports it as being eaten by the tody, cuckoo, flycatcher, vireos, Adelaide's warbler and the yellow-shouldered blackbird. Altho most of the earlier records are from the more humid parts of the Island, recent collections have been made at Ponce and Guánica, and Dr. Luis F. Martorell found it at light on Mona Island. It is so abundant on Mona, indeed, that one will find adults in the daytime resting on the foliage or twigs of trees. Presumably it also occurs on Vieques and Culebra, as it is recorded from St. Thomas and Guadeloupe.

Eburia portoricensis Fisher (1932–15), a very densely pubescent reddish-brown beetle, 20.0 to 25.0 mm. long, "with two pairs of small, oblong eburneous spots" ornating each elytron, is known from the type, collected at Aguirre Central, April 15, 1930, and one other at Río Piedras, November 19, 1945.

Elaphidion irroratum Linnaeus, dark reddish brown with dense whitish pubescence making characteristic patterns on thorax and elytra, is possibly the most striking of the numerous species of this genus found in Puerto Rico. One especially large individual, an inch and a quarter long, has denuded areas on the prothorax simulating eyes and an elongated nose, but smaller individuals have additional denuded areas on the lower cheeks. Drs. Gundlach and Stahl list this as *E. bidens* Olivier, the former noting, "No lo creo igual *E. irroratum* L." with which he was familiar in Cuba. It has an extensive distribution: Mexico and Nicaragua, as well as in the West Indies, Dr. Luis F. Martorell having found it abundant at light on Mona Island. He reared one adult of this species, as well as *Elaphidion spinicorne* Drury, from a dead trunk of *Albizia lebbeck* lying on the side of the Ponce road, and also adults of the Elaterid, *Chalcolepidius silbermanni* Chevrolat, a recent accidental introduction from Hispaniola, the

larvae of which are predaceous on Cerambycid larvae in their tunnels in dead tree trunks.

Elaphidion spinicorne Drury, with antennae scarcely more spiny than those of *irroratum*, and similarly dark reddish-brown, has dense yellowish pubescence spotting the elytra and normally denuded mostly along the median dorsal keel of the prothorax. Listed by Drs. Gundlach and Stahl, it occurs in all parts of Puerto Rico, recent collections having been made at Lares and Humacao, but is much more abundant on the xerophytic south coast, and on Mona Island, where it has repeatedly been collected.

Elaphidion mutatum Gahan (= *E. tomentosum* Chevrolat) is somewhat smaller, the greyish pubescence of the elytra being arranged in elongated areas. In fresh specimens, as those reared from prunings of crape myrtle (*Lagerstroemia indica*) by Dr. Luis F. Martorell at Río Piedras, such denudation is less noticeable. Larvae have also been reared to adult at Río Piedras in the wood of "cupey" (*Clusea rosea*), and adults collected at Palo Seco, Cayey and Maricao. The greyish pubescence of individuals rather doubtfully identified as this species by Mr. W. S. Fisher, collected by Mr. Miguel A. Pérez from a live tree of "aceitillo" (*Zanthoxylum flavum*) at Guánica, is entirely undenuded, even the spiny antennae being densely pubescent in the least rubbed individuals.

Elaphidion insulare Newman, barely half an inch long even in the largest specimens, and with apparently more spiny antennae because of its small size, has grayish pubescence in more or less elongated areas on the elytra of denuded individuals. Collected at Ponce and Mayagüez, and by Mr. Miguel A. Pérez on Mona Island, as determined by Mr. W. S. Fisher, it also occurs in the more humid parts of Puerto Rico, adults having been reared from larvae in hormiguilla-infested dead twigs that had fallen from the twin "jagüey" (*Ficus laevigata*) tree on the side of the road between Manatí and Ciales.

Elaphidion portoricensis Fisher (1932–33), of which the type is from Coamo Springs, others from Yauco and Ponce, is a "uniformly bright reddish brown, strongly shining,—each elytron with three white pubescent spots," the entire beetle being 8.0 to 11.0 mm. long.

Elaphidion nanum Fabricius, which Dr. Gundlach listed as *E. cinereum* Olivier, is only half an inch long in the largest individuals: yellowish-brown, with the lateral ridges of the prothorax more prominent and usually more denuded than the dorsal keel, more or less elongated denuded areas on the elytra. It occurs on Vieques Island, where it was collected by Dr. Stuart T. Danforth, but not on Mona Island, despite its occurrence in Hispaniola. Numerous collection of adults, usually at light, have been made in all parts of Puerto Rico, but nothing is known of the immature stages.

Elaphidion thomae Gahan has been found at San Germán and at Bayamón.

Elaphidion glabratum Fabricius, as doubtfully determined by Mr. W. S. Fisher, was collected at Utuado by Dr. Stuart T. Danforth.

Elaphidion conspersum Newman, described from Hispaniola, was collected at light, Sardinera beach, Mona Island, by Prof. J. A. Ramos, in April 1944.

Stizocera vanzwaluwenburgi, described by Mr. W. S. Fisher (1932–46) from specimens collected at Mayagüez, and others at San Germán and Coamo Springs, is "narrowly elongate, subcylindrical; above pale yellow, beneath brownish-yellow", varying in size from 11.5 to 19.0 mm. in length. Apparently this slender beetle is confined to the western end of Puerto Rico, all subsequent collections made by Dr. Stuart T. Danforth or his students are from Mayagüez and Añasco, the farthest east being Coamo on the south and Algarrobo (Tortuguero Lagoon) on the north.

Dr. Alex. Wetmore reports in the stomach contents of the owl and the flycatcher remains considered to be that of a species of *Compsa*, but possibly assignable to the former or one of the following.

Heterachthes ebenus Newman, as determined by Mr. W. S. Fisher, was collected by Prof. J. A. Ramos (iv–37) at Mayagüez.

Heterachthes quadrimaculata Fabricius, found in the Lesser Antilles, was first identified from Puerto Rico by Dr. E. A. Schwarz. It is a very slender beetle, cylindrical, normally about half an inch long, the four light yellow spots on the somewhat darker elytra far from prominent. Since the first collection at Guánica, it has been repeatedly found at Ponce, and in the mountains at Utuado and Lares, as well as on the north coast at San Juan and Pt. Cangrejos.

Cylindera flava Fabricius, 7.0 to 10.0 mm. long, shining, flattened, entirely yellowish, occurs in the Old World, as well as in Hawaii, Mexico, British Guiana, Florida, the Bahamas and most of the West Indies. Drs. Gundlach and Stahl list it from Puerto Rico as *Lampromerus pilicornis* F., and it is so common here generally that Mrs. Raquel Dester found it eaten by the introduced toad, *Bufo marinus*. Dr. Donald De Leon noted the "saffron yellow" larvae feeding between the wood and the bark of beefwood (*Casuarina equisetifolia*) logs at Guánica in April 1940, and pupating in the bark. In July 1937, Miguel A. Pérez and Luis F. Martorell had noted logs of "ucar" (*Bucida buceras*) on the beach at Guayanilla heavily infested. It is not very common on Mona Island, Dr. Martorell finding only one at light at Camp Kofresí in August 1939, and Prof. J. A. Ramos (1947–42) one other five years later.

Merostenus attenuatus White, listed as a *Lampromerus* by Dr. Gundlach, has since been collected at Ponce by Mr. R. G. Oakley on flowers of *Scirpus*

validus, and Dr. Luis F. Martorell found a single specimen at light on Sardinero beach, Mona Island in March 1940.

Plectromerus distinctus Cameron, a Hispaniolan species, has been reported from Puerto Rico.

Acyphoderes aurulenta Kirby, described from Brasil and formerly known only in addition from Argentina, listed by Drs. Gundlach and Stahl from Puerto Rico as *Odontocera abdominalis* Olivier, was first correctly identified from Puerto Rico by Mr. G. E. Bryant, the synonymy subsequently being published (Proc. U. S. National Museum, **77** (2842) Art. 19:12. Washington, D. C., 1930) by Mr. W. S. Fisher. Densely pubescent with bright golden yellow hairs, the elytra acutely triangular, showing the hind wings beneath, the basal segments of the antennae spinose, the apical ones flattened, these unique beetles display such varied characters that, when found resting on leaves or flowers, they are easily mistaken for some unique bee. Rarely collected at light, the beetles seem to have no connection with wood or trees, having been observed resting on cane leaves, in the midst of extensive cane fields, as at Coloso and at Toa Baja; on mango blossoms, as at Mayagüez, on leaves of *Psidium guajava*, as at Cayey, and at light at Ponce. Nothing is known of the immature stages.

Euryscelis suturalis Olivier is dull reddish brown, densely covered with erect dull yellow hairs, the inner half of the narrow elytra with recumbent whitish pubescence. It has extremely long legs, the femora and tibiae being each half an inch long, of a beetle only three-quarters of an inch in total length. Noted by Mr. Francisco Seín on October 17, 1925 at Guayama, where at 5 o'clock in the afternoon he found the adults running briskly over logs of mesquite or "bayahonda" (*Prosopis juliflora*) imported from Santo Domingo, it had previously been established in Puerto Rico, for nine years before collections had been made at light at Aguirre, and subsequently at San Juan and Bayamón, all identifications made by Mr. W. S. Fisher. Presumably this beetle is endemic in Hispaniola, but it is now known to occur in the Bahamas and southern Florida.

Neoclytus araeniformis Olivier, listed by Drs. Stahl and Gundlach, is dull purplish-brown in color, with characteristic whitish pubescent markings, 12.0 to 15.0 mm. long. The narrow elytra are spined at the apex, and the middle and posterior femora, greatly expanded and darkened, end in two spines, which are the more prominent because the beetle when alive normally rests with its tarsi and tibiae folded up beneath its body. Recorded also from Guadeloupe and Hispaniola, in Puerto Rico it has been found to date only in southwestern part of the Island: collections at Las Marías, Maricao, Añasco and Coamo Springs by Dr. Stuart T. Danforth apparently representing its extreme range. Adults have been reared from dead wood at Mayagüez and Yauco, and females have been observed

ovipositing in fresh logs of *Inga vera* at Indiera in the mountains between Yauco and Maricao, September 8, 1921. Logs of "ucar" (*Bucida buceras*), freshly-cut and being seasoned on the beach at Guayanilla, intended for use as the ribs of barges, were observed by Miguel A. Pérez and Luis F. Martorell as rendered quite unserviceable by the tunnels of the grubs of these beetles. The smaller larvae of *Cylindera flava* were boring between the bark and the wood of these logs, but those of *Neoclytus* were tunneling into the heartwood of the ucar.

Tilloclytus minutus was described by Mr. W. S. Fisher (1932–62) as "small, 4.8 mm. long, elongate, nearly glabrous and subopaque, above bluish-black, each elytron with a broad, transverse, white fascia at middle, connected posteriorly to a yellow vitta extending along the sutural margin to apex", the type from Tallaboa, collected by Mr. H. G. Barber on July 23, 1914. It has not been noted since.

Tilloclytus puertoricensis, one of the "New Cerambycid Beetles from Puerto Rico" (Jour. Agr. Univ. P. R., **19** (2): 51–63. Río Piedras, October 15, 1935) described by Mr. W. S. Fisher, is even smaller, 3.0 to 4.25 mm. long, with reddish elytra. The broad white transverse fascia on each elytron is bordered anteriorly with black, and an elongate black spot extends along the lateral margin nearly to the apex. The type and others were intercepted by Mr. R. G. Oakley in decaying wood in the Guánica Forest, October 3, 1934, but no additional collections have since been made.

Lamproclytus elegans was described by Mr. W. S. Fisher (1932–68) from a single female collected at Bayamón by Mr. R. C. Shannon, "3.8 mm. long, elongate, nearly parallel, strongly shining, black, except basal third of each elytron . . . brownish yellow, and each elytron ornamented with a transverse, eburneous fascia".

Lamproclytus oakleyi was described by Mr. W. S. Fisher (1935–52) from a single type intercepted by Mr. R. G. Oakley on *Tabebuia pallida* at Guánica, September 21, 1933. It is 3.25 mm. long, and differs from *L. elegans* in being uniformly dark reddish brown.

Rhopalophora pustulosa White, described from Venezuela, is reported from Puerto Rico.

Trachyderes nigripes Dupont, described from French Guiana, is doubtfully reported from Puerto Rico.

Neoptychodes trilineata Linnaeus, listed by Leng (1920–281) as a *Ptychodes* from Louisiana, Texas, Arizona and lower California, occurs also in Mexico, Central America, the northern part of South America, Trinidad, Puerto Rico, Jamaica and Cuba.

Monochamus titillator Fabricius, listed by Dr. Gundlach as a *Monohammus*, has not since been found in Puerto Rico.

What Dr. E. A. Schwarz determined as *Proecha spinipennis* Chevrolat

has been re-determined by Mr. W. S. Fisher as what he described (1926–3) from Cuba under the name **Ataxia alboscutellata**. It is elongate, subcylindrical, three-quarters of an inch or less in length, light brown in color with evenly scattered whitish pubescence, deeply punctured on elytra and pronotum, and may be distinguished by the ivory-white scutellum (whence the specific name *alboscutellata* given by Mr. Fisher), the segmentation of the antennae marked by whitish pubescence, and the three tubercles on the pronotum, one in front and one on each side. Puerto Rican specimens have been collected at Río Piedras, Pt. Cangrejos and Bayamón; by Dr. Stuart T. Danforth at Utuado, and by Mr. R. G. Oakley on dead wood at Guánica and on pomarrosa at Ponce. Among the "Insects and a Mite found on Cotton in Puerto Rico" (Bull. No. 39, P. R. Agr. Expt. Station, pp. 14, ref. 45. Washington, D. C., March 1939), Mr. L. Courtney Fife noted the larvae of this beetle boring in the stalks of cotton at Sabana Grande.

Ecyrus flavus was described by Mr. W. S. Fisher (1932–80) from a single female collected by Mr. R. H. Van Zwaluwenburg at Mayagüez, "elongate, 8.5 mm. long, robust, strongly convex above, uniformly pale reddish brown, rather densely clothed with short whitish and yellowish pubescence."

Ecyrus nanus was described by Mr. W. S. Fisher (1932–79) as "rather short, length 6.0 mm., robust, strongly convex above, uniformly reddish brown, densely clothed with whitish, brownish and yellowish pubescence": a single female collected by Mr. C. W. Leng at Boquerón, and another at Mayagüez by Mr. R. H. Van Zwaluwenburg. Dr. Donald De Leon found one of this genus on a rock beside a pile of old almácigo logs at Guánica. Both of these species are listed as *Callipogonius* by Mr. E. G. Linsley in his "Revision of the Pogonocherini of North America" (Ann. Ent. Soc. America, **28** (1): 73–103, pl. 1. Columbus, 1935).

Estola ignobilis Bates, a Central American Cerambycid, is listed from Puerto Rico, possibly in error for Costa Rica.

Oncideres lebasi, described by H. Dupont on p. 46 of his "Monographie des Trachydérides" (Guérin Magasin, Paris, 1936) from Puerto Rico, has not since been found.

Oncideres tessallata Thomson, of northern South America, is reported from Puerto Rico.

Cacostola leonensis Dillon & Dillon, described (Sci. Pub. No. 6, pp. 259–260, Reading Public Museum, Reading, 1946) from material collected at Coamo Springs by Dr. Stuart T. Danforth, is known only from the types.

Spalacopsis filum Klug, listed from Puerto Rico by Dr. Gundlach, and since found in a coffee grove at San Sebastián; by Dr. Stuart T. Danforth at Luquillo, and possibly this species on Malpighia flowers at Aibonito, is

an extremely slender and elongate beetle, with short, plump legs, which in life holds its antennae straight out in front of its head. By comparison with the slender antennae of Phasmids, it indicates how convergent development towards a similar end may find antennae useful, instead of an unavoidable nuisance and a deteriment to perfection of protective resemblance.

Oreodera glauca Linnaeus, found in Mexico, Central and the tropical parts of South America, is reported from many of the Lesser Antilles, and all of the Greater Antilles except Cuba.

Oreodera lateralis Olivier, described from Cuba, also occurs in Puerto Rico.

Steirastoma brevis Sulzer, found in most of South America and some of the Antilles, is reported from Puerto Rico.

Steirastoma histrionica White occurs in Mexico and Central America, in Jamaica and in Puerto Rico.

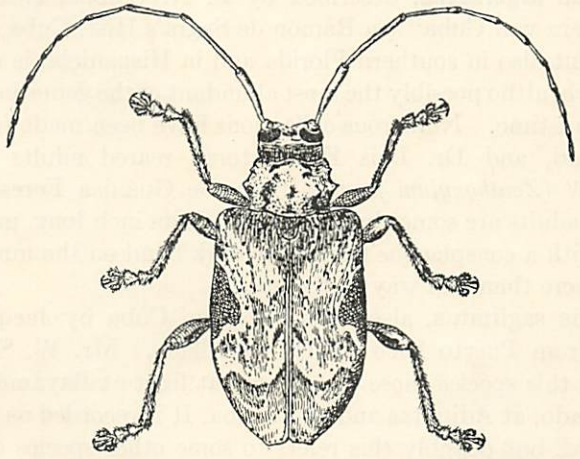
Acanthoderes circumflexa DuVal occurs in Mexico thru Central America to Venezuela, and in Cuba and Puerto Rico.

Lagochirus araeniformis Linnaeus is a somewhat flattened, robust, brownish Cerambycid, three-eights of an inch across at the humeral angles, and approximately twice as long, its antennae much longer than the body, which is marked with intricate wavy pattern of grey and lighter brown. Listed by Drs. Gundlach and Stahl, it is common in all the less elevated parts of Puerto Rico, and elsewhere occurs thruout tropical America from Mexico to Argentina, in all the Greater Antilles and in many of the Lesser, but has not been collected on Vieques, Culebra, Mona or Desecheo.

Despite the wide distribution of the species and the abundance of its squeaking adults, apparently nothing was known of the immature stages until Dr. Willis R. Whitney, founder and for many years in charge of the research division of General Electric Co., in February 1940, "while tramping along the West Bay Road, leading from Nassau, Bahamas, to the Golf Club, found a tree which had very peculiar, large holes through its bark. They were approximately round and varied from about one and a half to two inches in diameter. Over most of these holes were still attached the bark coverings nearly quarter of an inch thick. These reminded one of refrigerator doors, owing to their well-fitted, beveled edges. Automatically, we at once spoke of these as "trap-doors"." Of Dr. Whitney's most persistent search for the cause of these "trap-doors" in the bark of what in the Bahamas is locally known as "gumbo limbo" or "gum eleme," or more generally referred to as West Indian birch: the "almácigo" of Puerto Rico, *Bursera* (*Elaphrium*) *simaruba* (= *B. gummifera*), may be read in his privately printed "Isn't Research Fun" (Schenectady, N. Y., August 1941, and subsequently reprinted in the Caribbean Forester, **3** (2): 47–56, pl. 1.

Río Piedras, January 1942, and summarized in Entomological News, **53** (3): 60–62, pl. 1, ref. 5. Philadelphia, March 1942 by Dr. Raimon L. Beard as "A Note on *Lagochirus araeniformis* L.").

In part of a dead almácigo tree with similar cavities and "trap-doors" brought to the laboratory from Camuy on May 21, 1941, larvae and pupae were found, the chirping of the first adult signalizing its emergence on the 26th. Altho fully-grown larvae occurred in the cavities under the bark where they had completed their growth, they retired to the interior of the log for pupation. "In the quiet of the laboratory, one can hear the larva chewing just beneath the bark, and note exactly its location. But a day or two later, the "trap-door" begins to crack loose, and nothing is present



The Cerambycid Beetle, *Lagochirus araeniformis* Linnaeus, twice natural size. (Drawn by Fritz Maximilien.)

in the deserted chamber except the hole back into the center of the log where pupation will occur. The intriguing chamber is only a feeding cavity and nothing more."

The considerably smaller but quite similar *Lagochirus obsoletus* Thomas, which does not occur in Puerto Rico, was found by Mr. Patricio Cardin to be one of the most injurious of the "Insectos y Enfermedades de la Yuca en Cuba" (Bol. No. 20, Est. Expt. Agr., pp. 28, pl. 8. Santiago de las Vegas, 1911), several larvae often developing in a single shoot. His photographs indicate a comparable feeding of the nearly fully-grown larvae in the tissue just under the bark and "cuando ha llegado á su completo crecimiento la larva hace un agujero hasta llegar casi afuera para poder salir cuando adulto, forma su cámara con serrín y virutas arriba y abajo de él, con la cabeza hacia la salida y empieza á pasar sus metamórfosis". It is

possible that the bark of the manioc also cracks around the area where the larva has been feeding, but even the largest shoots are too small to develop the "trap-doors" which Dr. Whitney describes in the bark of the gumbo limbo.

Oviposition by the females of *Lagochirus araeniformis* does not occur in the living, uninjured tree, nor in dead, decaying logs on the ground, but in freshly-cut logs or branches, and the hatching larvae may develop to adult even in those which, when used for fence posts, take root and live. From the almácigo material brought from Camuy, adults of the predaceous Elaterid, *Chalcolepidius silbermanni* Chevrolat, later emerged, their larvae having fed upon the larvae and developed in the tunnels of the Cerambycid.

Leptostylus argentatus, described by P. N. Camille Jacquelin-Duval in "Coleoptera von Cuba" (*in* Ramón de Sagra's Hist. Cuba, VII, p. 273. 1857), present also in southern Florida and in Hispaniola, is not listed by Dr. Gundlach, altho possibly the most abundant of the genus in Puerto Rico at the present time. Numerous collections have been made from all parts of the Island, and Dr. Luis F. Martorell reared adults from pieces of "aceitillo" (*Zenthoxylum flavum*) from the Guánica Forest in October 1938. The adults are somewhat less than half an inch long, mostly grey in color, but with a conspicuous transverse dark band on the inner margin of the elytra more than half way to the apex.

Leptostylus sagittatus, also described from Cuba by Jacquelin-Duval, was listed from Puerto Rico by Dr. Gundlach. Mr. W. S. Fisher has identified as this species those intercepted at light at Bayamón, on grapefruit at Dorado, at Adjuntas and at Villalba. It is recorded as eaten by the crested lizard, but possibly this refers to some other species of the genus.

Of the nine species of *Leptostylus* which occur in Puerto Rico, all except the two just discussed have been described by Mr. W. S. Fisher from specimens collected within little more than the last score of years, and this is by no means all that may be present. Many of the species are small to of medium size, usually robust, mottled grey or brown, with exceptionally long antennae. Dr. Alex. Wetmore found that they had been eaten by the following birds: cuckoo, woodpecker, tody, owl, flycatcher, honey creeper, redstart and several vireos and warblers.

Leptostylus longicornis, so named by Mr. W. S. Fisher (Proc. U. S. National Museum, **68** (2623) Art. 22: 1–40. Washington, D. C., 1926) because of its extremely long antennae, was described from a single male, 11.5 mm. long, 4.5 mm. wide, bearing the label "Porto Rico Exp. Sta." (which is the Station at Mayagüez, not that at Río Piedras, as inferred by Mr. Fisher). Subsequent identifications by Mr. Fisher, in addition to an undersized adult from Aibonito, are: at light at Mayagüez, on dead wood at Adjuntas, resting on bark of *Inga vera* at Lares, on firewood at Lares,

and in tunnels of a log at Naguabo. These are "uniformly reddish-brown, densely clothed with cinereous pubescence," most obviously marked with a denuded median darker area on the pronotum opposite the dark scutellum, the pubescence being considerably lighter in the specimens from Naguabo.

Leptostylus antillarum, one of the "New West Indian Cerambycidae (Coleoptera), Subfamily Lamilinae" described by Mr. W. S. Fisher (American Museum Novitates No. 174, pp. 16. New York, May 28, 1925) from types and paratypes collected by Mr. August Busck on Culebra Island in February 1899, and one collected on cacao at Mayagüez by Dr. C. W. Hooker, is "strongly robust and moderately convex above, length 11.0–12.0 mm., width 5.0–5.2 mm., uniformly reddish brown to brownish black, rather densely clothed with pale brownish pubescence, and ornated with a few darker and paler areas." Subsequent collections of adults have been made at light at Bayamón, on *Derris eliptica* at Río Piedras, on dead wood at Yauco, all identified by Mr. Fisher, as well as adults reared from larvae under bark of stump at Dorado, and larvae and pupae in rotten fence post at Maricao.

Leptostylus albosignatus Fisher (1935–53), the type from Ponce, the paratype from Bayamón, is "allied to *antillarum* Fisher, but differs from that species in having a distinct, large, white pubescent spot on the elytra."

The type of **Leptostylus gundlachi** Fisher (1925–2), only 6.0 mm. long, 2.75 mm. wide, "reddish brown, not very densely clothed with brownish-white pubescence, with an obsolete opalescent tinge and a few dark brown areas," was from Aibonito. An adult, identified by Mr. Fisher, has been reared from a pod of *Erythrina glauca* at Río Piedras.

Leptostylus oakleyi, another small species, 4.5 mm. long, 1.8 mm. wide, described by Mr. W. S. Fisher (1935–54) from a single specimen collected at light at Bayamón, "is allied to *gundlachi* Fisher, but differs in the arrangement of the brown pubescence on the elytra, and in having a broad, dark brown, pubescent vitta on each side of the pronotum." Others had previously been taken at light at Río Piedras, as subsequently identified by Mr. Fisher.

Leptostylus nigricans, described by Mr. W. S. Fisher (1935–55) from a single type collected by Mr. R. G. Oakley at Villalba, is even smaller, 4.0 mm. long, 1.75 mm. wide, "elongate, moderately flattened above, brownish yellow, with the basal halves of elytra, disc of pronotum, tips of antennal joints, tarsi, and parts of the head, tibiae and femora, black or dark brown and rather densely pubescent".

Leptostylus puertoricensis, 4.0 mm. long, 1.75 mm. wide, described by Mr. W. S. Fisher from a single specimen collected by Mr. R. G. Oakley at Adjuntas, is "elongate, moderately flattened above, brownish black to brownish yellow, rather densely pubescent."

Trypanidius nocturnus, described by Mr. W. S. Fisher (Jour. Agr. Univ. P. R., **25** (4): 38. Río Piedras, April 7, 1942) from a single female collected by Dr. Luis F. Martorell at Villalba, May 18, 1940, is "broadly elongate, uniformly dark reddish-brown, length 15.0 mm., each elytron ornamented with a black pubescent spot along sutural margin behind scutellum and a narrow arcuate one behind middle, the apical fourth yellowish-white, tip obtusely angulated; pronotum with short acute tubercle on each side behind middle."

Lepturges guadeloupensis Fleutiaux & Sallé, in size comparable to the smallest of the *Leptostylus*, occurs in several of the Lesser Antilles, as well as in Cuba and Puerto Rico. Dr. Alex. Wetmore records it eaten by the tody, and it also serves as an item of food for the crested lizard. Dr. W. A. Hoffman found adults inside dead branches of "flamboyán" (*Delonix regia*) in the patio of the School of Tropical Medicine, and they have been noted burrowing inside hibiscus twigs at Mayagüez; in "mangle" (*Rhizophora mangle*) at Loíza; in "burro" (*Capparis flexuosa*) at Santa Isabel; as well as resting on dead wood and on orange tree at Ponce; in coffee groves at Ciales and Villalba, and resting on cotton at Guayanilla. From a larva found inside a pod of "aroma" (*Acacia farnesiana*) at Boquerón on April 24, 1923, an adult was reared: possibly indicating the normal, but more probably an atypical host for the immature stages.

Probatius umbraticus J. DuVal, found in southern Florida and Cuba, was listed from Puerto Rico by Dr. Gundlach, and has since been collected by Mr. R. G. Oakley at Ponce on "moca" (*Andira jamaicensis*).

Eugamandus oakleyi was described by Mr. W. S. Fisher (1935–57) from a single specimen collected by Mr. R. G. Oakley in decaying wood at Matrullas Dam, near Orocovis. It is 5.75 mm. long, 3.0 mm. wide, "short, oblong, strongly convex, subopaque, uniformly reddish or yellowish brown, each elytron ornamented laterally with an irregular, black pubescent vitta."

Eugamandus brunneus was described by Mr. W. S. Fisher (1935–58) from material collected by Mr. R. G. Oakley from vegetable debris at Indiera in the mountains north of Yauco, being "very closely allied to *oakleyi* Fisher, but much smaller and more slender, and differs in having tubercles on each elytron arranged in two longitudinal rows".

Eugamandus flavipes Fisher (1935–58), collected by Mr. R. G. Oakley at Villalba, also "is allied to *oakleyi* Fisher, but differs in having the elytra evenly convex, arcuately declivous posteriorly, and each elytron armed with only two distinct tubercles".

Cyrtinus eugeniae, described by Mr. W. S. Fisher (1935–60) from material collected by Mr. R. G. Oakley at Aibonito on "pomarrosa" (*Eugenia jambos*), is only 2.0 mm. long, 0.63 mm. wide, "elongate, feebly shining;

head, pronotum and abdomen dark reddish brown; antennae, legs and elytra slightly paler, the latter dark reddish brown along lateral margins".

Cyrtinus oakleyi, described by Mr. W. S. Fisher (1935–62), who named it for the Plant Quarantine Inspector who intercepted it at Indiera, in the mountains north of Yauco, is only 1.75 mm. long, 0.6 mm. wide, being "allied to *eugeniae* Fisher, but differs in being strongly shining, in having the pronotum as wide as long, and each elytron ornamented with two reddish brown spots".

Cyrtinus subopacus Fisher (1935–61), of which the type is from Adjuntas, is 2.5 mm. long and 0.75 mm. wide, "allied to *eugeniae* Fisher, but differs in being larger and subopaque, and in having the punctures on the elytra elongate".

Chrysomelidae: Leaf Beetles

Chrysomela, the type genus of the Chrysomelidae, is derived from two Greek words meaning "gold" and "fruit." Only a few of the species found in Puerto Rico are golden, but many are iridescent or brightly colored. **Lema dorsalis** Olivier, for instance, has a shining orange pronotum, broad diagonal and transverse bands of yellow on deeply punctured purplish-blue elytra, dark orange head, black eyes and antennae, and blue-black legs. Slender and usually less than 5.0 mm. long, in size and brightness of coloration it is typical of the family. A widely distributed species, with a range including Mexico, Central and northern South America and most of the Antilles, it is especially abundant in the western part of Puerto Rico, notably around Mayagüez, where it was first collected by Dr. Gundlach.

Lema nigripes, described from Puerto Rican material collected by Dr. Gundlach, by Herr Julius Weise in his "Beitrag zur Chrysomeliden— und Coccinelliden—Fauna Portorico's" (Archiv fur Naturgechichte, **51** (1): 144–168, pl. 8. Berlin, 1885), and not since found elsewhere, has not only black legs, but also black antennae and eyes, an orange yellow body and dark blue elytra. Since Dr. Gundlach's collection of the type, it has been found in many localities in the more humid parts of the Island. Dr. Stuart T. Danforth found it eaten by Adelaide's warbler, and it has been noted in the stomach of the crested lizard. Dr. Alex. Wetmore found beetles of this genus eaten by the ani, tody, wood pewee, black and white warbler and the honey creeper. Nothing is known of the immature stages of these beetles, or even of the preferred host plants eaten by the adults, for most have been swept from grass or weeds, or collected resting on crotalaria flowers, or on foliage of cocozelle squash or commelina.

Lema polita, described from Puerto Rico by J. T. Lacordaire in his "Monographie des Coleopteres Subpentameres de la Famille des Phyto-

phages, Vol. 1" (Mem. Soc. Royal Sci. Liege, **3:** 355. Liege, 1845), and not since found elsewhere, is entirely black except for blue elytra. Recent collections have been made at Río Piedras and at Bayamón. Dr. Stahl lists this species as *Lema placida* Lacordaire, and also lists from Puerto Rico *Lema poeyi*, which Lacordaire had described from Cuba, and *Lema confusa* Chevrolat, neither of which has since been found here.

Pachybrachis mendica Weise (1885–153), endemic in Puerto Rico, where it was first collected by Dr. Gundlach, has since been found on Mona Island by Prof. J. A. Ramos. Dr. Stuart T. Danforth found it on acacia at Guánica and Tallaboa, and Mr. R. G. Oakley on *Randia mitis* at Ponce. Other specimens collected by Mr. Oakley on mangrove at Ponce and Guánica were thought by Mr. H. S. Barber to be a new species of *Pachybrachis*.

Pachybrachis praetextata, an endemic species described by C. G. L. Eduard Suffrian, "Zur Kentniss der Nordamerikanischen Cryptocephalen" (Linnaea **6:** 282–3 & **7:** 203. 1852) has not since been noted in Puerto Rico.

Cryptocephalus, meaning "concealed head," is the name given to those Chrysomelid beetles which have "the head so deeply immersed in the strongly convex thorax that it can be scarcely or not at all seen when viewed from above."

Cryptocephalus nigrocinctus, described by Suffrian (1852(**6**)–282), an endemic species found only here, is by far the most abundant of the genus locally: almost entirely blue-green to dull purplish brown in color. *Cryptocephalus tristiculus* Weise (1885–147) is apparently the same species, not since reported from outside of Puerto Rico. Individuals vary greatly in size, smoothness of punctation of thorax, the size and distinctness of the pale mark on the central portion of the basal segment of the abdomen, and in general color; most of the females being blue-green and most of the males dull purplish-brown, but with no sharp distinction between intergrading forms. In thirty specimens collected from the leaves and terminal shoots of mangrove (*Rhizophora mangle*, *Laguncularia racemosa* and *Conocarpus erecta*) on the shores of Laguna San José, near Río Piedras, July 4, 1923, all combinations and variations were noted, as detailed in "Insectae Portoricensis" (1923–112). Two of these individuals showed traces of the yellow spots from which Herr Weise may have derived his name *tristiculus*, and one collected December 8, 1939 in a cane field at Fajardo distinctly shows six yellow spots margining the prothorax and three on each elytron. Dr. Gundlach lists both names, and Mr. H. S. Barber identifies most specimens submitted as **C. tristiculus**. Despite the abundance of the adults, nothing is known locally of the immature stages. The adults have been found generally in the more humid portions of the Island, from the coast to

the interior valleys, but not in the mountains, and only rarely on the xerophytic south coast. They feed on the leaves, and sometimes on the flowers, of a great variety of host plants, mostly weeds of no value, or trees, and only incidentally on economic crops. Indeed, altho one might consider that their morphological variations are matched by the non-selectivity of their host preferences; when found on one plant, rarely are they also feeding on near-by alternate hosts. The list of those on which they have been observed feeding includes the flowers of mango at Mayagüez, of *Inga laurina* at Yauco, and of the wild marguerite (*Bidens pilosa*) at Cidra; and the leaves of orange at Arecibo and Adjuntas, of grapefruit at Río Piedras, Vega Baja and Mayagüez, of cotton at Arecibo, Aibonito, Algarrobo and Quebradillas, of pepper at Ponce, of cassava at Lares, of roses at Río Piedras and Aibonito, of tobacco at Cayey, of "fresas" (*Rubus rosaefolius*) at Cayey, of *Stigmaphyllom tomentosusm* at Ciales, of "jagüey" (*Ficus stahlii*) at Ponce, of "guano" (*Ochroma pyramidale*) at Cayey, of eucalyptus at Mayagüez, of seagrape (*Coccoloba uvifera*) at Humacao Playa, of "capá cimarrón" (*Cordia borinquensis*) at Camuy, of "sauce" or Humboldt's willow (*Salix chilensis*) at Florida, of *Psidium guajava* at Juncos and Cayey, of *Dalbergia hecastophyllum* at Humacao, Algarrobo and Tortuguero, of "icaco", (*Chrysobalanus icaco*) at Pt. Salinas, of *Inga laurina* at Lares, of *Inga vera* at Mayagüez and Río Piedras, of "almendro" (*Terminalia catappa*) at Arecibo. It may be presumed that many other native and introduced plants may also at times serve as food for the adults.

Because of the abundance of these beetles, they are eaten by all the species of arboreal lizards, and even by the local iguana, *Ameiva exsul*. Dr. Stuart T. Danforth reports finding them eaten by the black-throated blue and the northern parula warblers, and Dr. Alex. Wetmore noted that some species of *Cryptocephalus* were eaten by five species of warblers, the redstart, vireos and also by the oriole, martin, swallow, wood pewee, flycatcher, petchary, kingbird and tody. Quite aside from the intrinsic beauty of these quaint little sculptured Chrysomelids, they might be considered esthetically valuable because to such a large extent they serve as food for vireos and warblers.

Cryptocephalus perspicax Weise (1885–151), an endemic species not found outside of Puerto Rico, is bright yellow in color, the light brown prothorax and elytra usually having large, but sometimes small, yellow spots. It is not nearly so abundant as the blue-green species, but adults are to be found feeding on much the same plants, altho not at the same time or at the same locality. Dr. E. A. Schwarz determined those from Quebradillas feeding on the leaves of seagrape (*Coccoloba uvifera*), later confirmed by Mr. A. J. Mutchler, and subsequent records are on leaves of *Inga vera* at Río Piedras; on *Inga laurina* at Mayagüez, Ponce, Aibonito

and Comerio; on *Dalbergia hecastophyllum* at Pt. Salinas; on *Myrcia* sp. at Ciales; on "moca" (*Andira jamaicensis*) at Mameyes; on *Solanum torvum* at Río Piedras. Adults have been found in the stomachs of the lizards *Anolis stratulus* and *Anolis gundlachi*, and presumably they are eaten by vireos, warblers and other small insectivorous birds.

Cryptocephalus stolidus Weise (1885–149), as identified by Mr. A. J. Mutchler, has bright yellow elytra of which only the punctures are brown, or, to quote Weise's description, "elytris profundo punctatostriatis." Adults have been collected on the leaves of *Solanum torvum* at Ciales, Mr. R. G. Oakley found it on *Ficus* at Ponce, and Dr. Stuart T. Danforth had specimens from Guánica and Aibonito. It occurs only in Puerto Rico. As illustrated by Weise, the above two species seem quite distinct, but in an extensive collection from various localities and hosts, all sorts of gradations occur, some beetles being almost entirely brown with very small yellow spots, while others are almost entirely yellow. Of the eight specimens which Mr. Thos. H. Jones collected on *Inga vera* at Comerio, showing the maximum variation, which he thought might represent "perhaps two species mixed," the presence of intermediates presumably indicates that all are the same species.

Cryptocephalus multiguttatus Suffrian, of which specimens as determined by Mr. H. S. Barber were collected by Dr. Stuart T. Danforth at Faro de Cabo Rojo, and of which numerous specimens were found by Prof. J. A. Ramos on Mona Island, also occurs in Hispaniola. By Weise it is compared with his "rufobrunneus" **Cryptocephalus krugi** (1885–148), which has 22 spots on the two elytra. Previously known only from Puerto Rico, Prof. J. A. Ramos has specimens determined as "near" this species from Mona Island. Dr. Stuart T. Danforth had specimens from Ponce, Yauco and Mayagüez, and reports (1931–87) it eaten by the Jamaican vireo.

Cryptocephalus tortuosus Suffrian, a Cuban species, is listed by Herr Weise from Puerto Rico without comment, and Dr. Gundlach has this record, and also that of **Cryptocephalus polygrammus** Suffrian (1852–85), of which the type is from Puerto Rico. Leng & Mutchler (1917–210) list the Cuban and Jamaican **Cryptocephalus viridipennis** Suffrian. Specimens to which these names might be applied have not since been found in Puerto Rico, altho numerous individuals have been intercepted by Mr. R. G. Oakley in southern Puerto Rico to which specific names were not assigned by Mr. H. S. Barber.

Diachus nothus, described by Weise (1885–152) as a *Cryptocephalus*, is much smaller than any of the previous species, and can be readily distinguished by its bright yellow pronotum and iridescent blue elytra. Dr. Gundlach lists it, and notes, "no en Cuba, donde vive *C. pusio* Suffrian,

que es muy parecido". As *Cryptocephalus pusio*, Dr. Alex. Wetmore reports it eaten by the tody, elainea, cliff swallow, parula warbler and honey creeper, but none was found in the stomach contents of any of the lizards examined. Mr. H. S. Barber noted the occurrence of smaller, non-typical varieties from Puerto Rico which have black elytra, but yellow head and legs, while the smallest ones are entirely black or piceous. Like the the larger *Cryptocephalus*, these smaller and brighter or darker beetles also feed on the leaves of *Inga vera* and *Inga laurina* in the coffee groves of the mountains or on grapefruit foliage in the groves along the coast, and Mr. R. G. Oakley found them on the flowers of "pomarrosa" (*Eugenia jambos*) at Aibonito.

Triachus cerinus LeConte, described from Florida, is among the smallest of the Chrysomelids. According to the identification by Mr. H. S. Barber, it was found by Mr. R. G. Oakley on the flowers of *Randia mitis* at Ponce.

Chlamisus straminea Suffrian, described originally from Cuba, was first recorded from Puerto Rico as a species of *Chlamys* found by Dr. Alex. Wetmore in the stomach contents of the northern parula warbler. Later, specimens were collected by Mr. R. G. Oakley at Ponce on *Dioscorea* and *Ocotea*, and on flowers of "pomarrosa" (*Eugenia jambos*) at Aibonito. The flowers of pomarrosa at Aibonito also harbored other small Chrysomelids identified by Mr. H. S. Barber as species of **Exema.**

Lamprosoma longifrons Lacordaire, listed from Puerto Rico by Weise (1885–154) and by Dr. Gundlach, has subsequently been collected by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*) in the mountains back of Ponce, and on undetermined host at Indiera, in the mountains back of Yauco.

Nodonota wolcotti a bronze-black beetle, shining, finely and evenly punctured, each puncture with a short white hair; antennae, tibiae and tarsi brown, was described by Mr. G. E. Bryant in his "New Species of Phytophaga" (Ann. & Mag. Nat. Hist., **13** (9): 299. London, March 1924) from material taken on sagebrush or wild croton at Aguadilla. It is a conspicuous and relatively common insect of "yerba bellaca" (*Croton humilis*), not only in the more xerophytic parts of Puerto Rico but also on Mona Island. One individual has been found hiding in an Attelabid egg-roll of seagrape (*Coccoloba uvifera*) at Mameyes, and others intercepted at Luquillo on the beach. It has also been intercepted on "mabí" (*Colubrina reclinata*) at Mayagüez, and by Mr. R. G. Oakley at Guánica, and on cotton flowers and wild morning glory at Ponce.

Colaspis alcyonea Suffrian, a Cuban species listed by Weise (1885–155) and Dr. Gundlach from Puerto Rico, is represented in subsequent collection by a single specimen taken by Mr. Thos. H. Jones on weeds in a clearing on El Yunque, identified by Dr. E. A. Schwarz as probably this

species. It is an elongate brownish beetle with light greenish iridescence most marked on pronotum and head.

Alethaxius puertoricensis, described by Mrs. Doris Blake (Jour. Washington Acad. Sci., **35** (10): 327. Washington, D. C., 1945) from material from El Yunque, is a small, pale yellow-brown Chrysomelid, of which the males are "without the elytral warts and rugosities" characterizing the females.

The male of **Alethaxius yunquensis,** one of "Seven New Species of West Indian Chrysomelidae (Coleoptera)" (Proc. Ent. Soc. Washington, **48** (5): 111–119, pl. 1. Washington, D. C., June 21, 1946) described by Mrs. Blake from males collected by Dr. P. J. Darlington, is "4.0 mm. in length, oblong, shining cupreous with greenish lustre above" and is characterized by the uneven depressions on the pronotum.

The female of **Alethaxius semicostatus** Blake (1946–118) "is by far the largest species yet known from the West Indies", being "6.0 mm. in length, oblong, shining cupreous, prothorax uneven and with toothed margin".

Alethaxius meliae "also occurs in Puerto Rico", according to Mrs. Blake (1946–119).

Metachroma antennalis, a shining brown endemic Chrysomelid of Puerto Rico, described by Weise (1855–155) as "rufo-testacea", 3.3 mm. long, was found by Dr. Alex. Wetmore in the stomach contents of the oriole and several warblers. At times, this beetle may become very abundant, and outbreaks of adults have been reported attacking cotton at Quebradillas in June 1922, and the foliage of rose bushes at Aguirre in 1932. When less numerous, they have been found hiding during the daytime in the bracts of the squares and bolls of cotton, in spider nests or in the curled-up leaves of various plants. They are attracted to light at night, sometimes in large numbers. All the records of occurrence are in the western part of the Island: Arecibo, Hatillo, Guajataca, Aguadilla, Guánica Lagoon, Ponce, Coamo and Aguirre, and apparently this species is not found high in the mountains or in eastern Puerto Rico.

The Cuban **Metachroma liturata** Suffrian was first reported from Puerto Rico by Dr. Alex. Wetmore as forming an item of the food of the oriole, and later Mr. H. S. Barber identified as this species the beetles collected by Mr. R. G. Oakley on "ucar" (*Bucida buceras*) at Juana Díaz.

The Hispaniolan **Metachroma wolcotti** Bryant, as identified by Mr. H. S. Barber, was also found on "ucar" (*Bucida buceras*) at the same time and locality that the Cuban species of this genus was collected by Mr. Oakley. To numerous other beetles of this genus intercepted in coffee groves in the mountains, and on guava bushes at Bayamón, Aibonito and Villalba, and on various other hosts in the higher mountains, Mr. Barber assigns no specific name, considering them to represent one or more new species.

To the Puerto Rican representative of "The Species of **Myochrous** from the West Indies (Coleoptera)" (Proc. Ent. Soc. Washington, **49** (1): 22–28, pl. 1. Washington, D. C., January 15, 1947) Mrs. Doris Blake assigns the name **portoricensis.** It is 5.0 to 6.0 mm. in length, "oblong, piceous, covered with grayish yellow, closely appressed scales, the thorax with three teeth along the side, not so deeply punctate", the type having been collected in February 1899 at Arroyo by Mr. August Busck. Specimens found in the stomach of the killdeer at Guánica Lagoon in May 1912 by Dr. Alex. Wetmore are also cited by her, and it may be presumed that others listed by Dr. Wetmore, eaten by the ani, woodpecker, flycatcher, cliff swallow, honey creeper, vireos and warblers, are of this species, which apparently was exceptionally abundant at the time of his investigation on the food of "The Birds of Porto Rico". The specimens later swept from swamp vegetation at Boquerón, identified by Mr. G. E. Bryant as *Myochrous armatus* Baly, agree with Mrs. Blake's description of *portoricensis*, and presumably indicate that but a single species occurs in Puerto Rico. All records are of occurrence on the south side of the Island: by Dr. P. J. Darlington and Prof. J. A. Ramos at Guánica Lagoon, and by Dr. Luis F. Martorell, resting on cane leaf at Salinas.

Leucocera laevicollis Weise (1885–156) is a large, plump, iridescent blue Chrysomelid, "nigro-violacea, subtus interdum cyanea, long 6.0 mm.", according to the original description of specimens which presumably Dr. Gundlach had collected at Mayagüez. The next record is from near Río Piedras, where in December 1922 these beetles were found on *Malpighia coccigera* in the Seboruco woods, opposite the Isle of the Caves, Laguna San José, and again on the same host and at the same locality in June 1923. In September 1936, Prof. J. A. Ramos made extensive collections at Mayaguez, the species subsequently becoming so abundant on its specific host as to be discussed in the 1939 report of the Mayagüez (Federal) Agricultural Experiment Station (1940–116), as follows:

"In April numerous bright steel-blue beetles about 7 millimeters long were noted feeding on the young leaves of the native red cherry, cereza colorada (*Malpighia punicifolia* L.) at Mayagüez. The feeding of both the larvae and the adults of this insect prevented the normal leafing of five small trees that were being used for ornamental purposes on the station grounds. Towards the latter part of May, or about 6 weeks after injury became conspicuous, practically all the leaves had been consumed and the bark of the twigs up to slightly more than three-fourths of an inch in diameter were being fed upon. So extensive and severe was the subsequent feeding that the trees were kept leafless, one of the trees died, and most of the remaining trees were being killed by girdling".

Phaedon sp. is the identification by Mr. H. S. Barber of beetles intercepted by Mr. R. G. Oakley at Indiera at Km. 22 on the Yauco-Lares road.

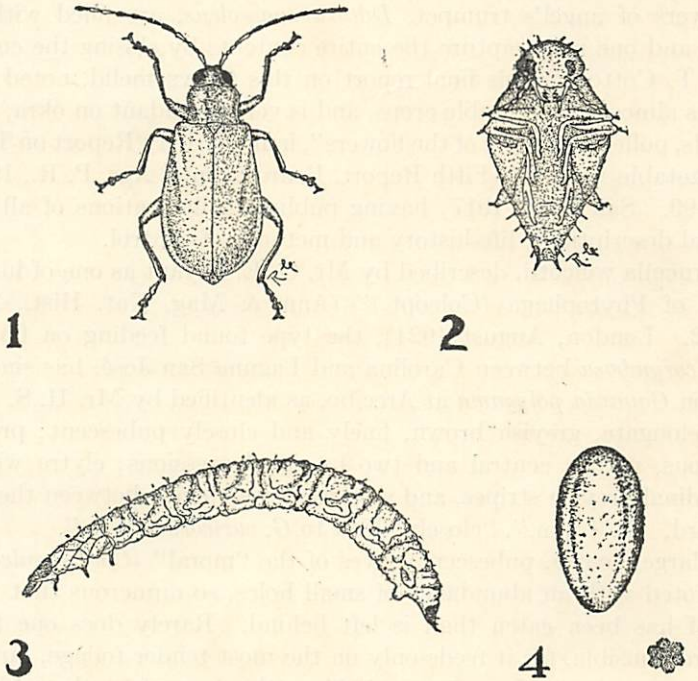
Of the very numerous species of *Diabrotica* which occur in the neotropics, Puerto Rico actually has less than half of the few listed. *Diabrotica aeruginea* Fabricius has not been collected here since the original record from Puerto Rico. The record of the Costa Rican *Diabrotica dorsoplagiata* Jacoby in Puerto Rico is apparently due to the confusion of names of the two countries. Dr. Stahl's name of *Diabrotica thoracica* Fabricius is in synonymy with *Diabrotica quadriguttata* Olivier, listed by Weise and Dr. Gundlach, but no specimen to which these names might be applied has since been found here. *Diabrotica impresa* suffrian has not been collected recently.

Diabrotica annulata Suffrian, as identified by Mr. H. S. Barber, has been intercepted on squash at Barceloneta and on wild cucumber at Villalba, but it is by no means abundant, or tending to become a pest of cultivated curcurbits.

Diabrotica bivittata Fabricius and **Diabrotica innuba** Fabricius are common economic species, each having a black head, shining bright orange-red prothorax, closely and densely punctured yellow elytra, black on the central margin and in a broad median band, so that Fabricius' name of *bivittata* (two-banded) applies equally well to either species. The larger is *innuba*, of which the "legs are partly black, elytral apices dentate"; the smaller *bivittata* has "legs entirely testaceous, elytral apices not dentate", to quote from Dr. E. A. Schwarz, veteran systematic and economic coleopterist. These are specifically pests on curcurbitaceous plants, having been repeatedly collected on cucumbers, melon, squash, pumpkin, canteloupe, watermelon, Chinese cabbage and wild cucumber in all the more humid parts of the Island, feeding chiefly on the flowers, of which they are exceptionally fond, but more rarely eating the tender young leaves. By accident, they may be sometimes found resting on other vegetation. Both are listed by Drs. Stahl and Gundlach, and by Weise, giving *Diabrotica pallipes* Olivier in synonymy with *D. bivittata*. Leng & Mutchler record *D. innuba* from Culebra Island. Mr. R. H. Van Zwaluwenbug noted the occurrence of both species on beans as well as on curcurbits, Mr. W. V. Tower conducted preliminary tests in control by spraying with Bordeaux and arsenate of lead, while Mr. D. W. May, Director of the Mayagüez Station, mentions them as being eaten by the newly introduced Surinam toad, *Bufo marinus*. At Río Piedras, Mr. Thos. H. Jones had noted their preference for flowers, but the first intensive life-history studies were made by Dr. Richard T. Cotton as presented in his paper on the "Insects Attacking Vegetables in Porto Rico" (Jour. Dept. Agr. P. R., 2 (4): 265–317, illus. San Juan, October 1918). "The beetles lay their small yellow eggs in the soil around the roots of plants, and the larvae,

which are slender, white, worm-like creatures, feed on and tunnel in the roots".

The light bluish-green **Diabrotica graminea,** possibly thus named by Mr. J. S. Baly in his "Descriptions of Uncharacterized Species of *Diabrotica*" (Trans. Ent. Soc. London, **4:** 443. London, December 1886) because of its grass-like color, occurs only in Puerto Rico and on Vieques Island. Undescribed at the time that Dr. Gundlach was here, it surely must have been collected by him, and possibly is what he and Weise list



Diabrotica graminea Baly: 1, adult, 2, pupa, 3, fully-grown larva, all about five times natural size; 4, egg, very greatly enlarged, with detail of sculpturing below. (Drawn by R. T. Cotton.)

as *Diabrotica quadriguttata* Olivier, and Dr. Stahl as *Diabrotica thoracica* Fabricius. Leng & Mutchler list it from Vieques Island, and Dr. C. W. Hooker considered it most "abundant on the south side of Porto Rico". Admittedly it may not be as common at Mayagüez as elsewhere, Dr. Stuart T. Danforth having few specimens from the immediate environs of the "Sultana del Oeste", but distribution seems to be quite general thruout the Island. Dr. Alex. Wetmore found this beetle to have been eaten by the ani, tody, petchary and grasshopper sparrow, but we have no record of

its being eaten by the introduced toad, or any of the endemic lizards. As to hosts, Mr. R. H. Van Zwaluwenburg mentions beans, squash, sugar-cane and bucare, and both Mr. D. L. Van Dine and Mr. E. G. Smyth note its occurrence on sugar-cane. Mr. Thos. H. Jones also found it "very common on leaves of sugar-cane, but with injury most severe on corn and okra, on flowers of cowpeas and to the foliage of *Spondias lutea* and *Amaranthus spinosus*". Other plants on which it has been noted in abundance are: tomatoes, eggplant, wild eggplant, pepper, potato, peas, pigeon peas, cundeamor, crotalaria, lima bean, soybeans and orange. At times, the flowers of angel's trumpet, *Datura suaveolens*, are filled with these beetles, and one may capture the entire contents by closing the entrance. Dr. R. T. Cotton, in his final report on this Chrysomelid, noted that it "attacks almost all vegetable crops, and is very abundant on okra, feeding on petals, pollen and pistil of the flowers", in his earlier "Report on Tobacco and Vegetable Insects" (Fifth Report, Board Comm. Agr. P. R., 1915–16, pp. 86–99. San Juan, 1917) having published illustrations of all stages, technical descriptions, life-history and methods of control.

Galerucella wolcotti, described by Mr. G. E. Bryant as one of his "New Species of Phytophaga (Coleopt.)" (Ann. & Mag. Nat. Hist., **14** (9): 247–252. London, August 1924), the type found feeding on flowers of *Cordia corymbosa* between Carolina and Laguna San José, has since been found on *Gouania polygama* at Arecibo, as identified by Mr. H. S. Barber. It is "elongate, greyish brown, finely and closely pubescent; prothorax testaceous, with a central and two lateral depressions; elytra with four longitudinal greyish stripes, and a feble greyish stripe between the second and third. L. 4 mm.", "closely allied to *G. varicornis* Wse.".

The large, coarse, pubescent leaves of the "moral" (*Cordia sulcata*) are often noted with an abundance of small holes, so numerous that more of the leaf has been eaten than is left behind. Rarely does one find the insect responsible, for it feeds only on the most tender foliage, but collections were made at Mayagüez in 1923 on this host of beetles which were determined by Dr. E. A. Schwarz as **Galerucella varicornis** Weise (1885–157), presumably described from material collected at Mayagüez by Dr. Gundlach. Prof. J. A. Ramos has made additional collections since at Mayagüez, but the insect is not confined to the Mayagüez region, as specimens have been found at Ponce, Villalba and El Verde (Río Grande).

Galerucella obliterata, described by A. G. Olivier in his "Entomologié 6" (**93:** 635. Paris, 1808), is a third endemic species of this genus from Puerto Rico, all three of which are found only here. Small beetles, the stripes on their elytra curved, collected feeding on the leaves of *Lantana camara* at Río Piedras, are presumed to be this species.

Luperodes antillarum, described by Mrs. Doris Blake as one of her "Ten

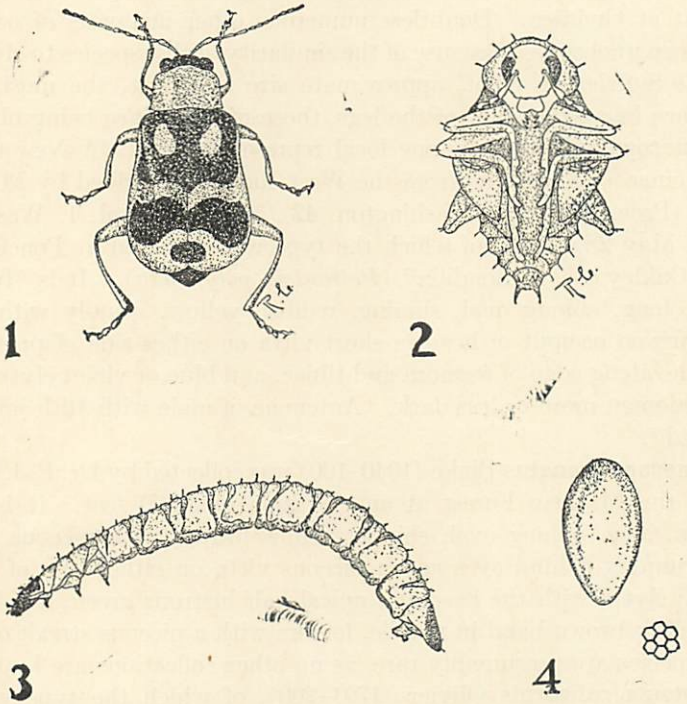
New Species of West Indian Chrysomelidae (Coleoptera)" (Proc. Ent. Soc. Washington, **39** (4): 67–88, pl. 1. Washington, D. C., April 27, 1937), is "elongate oblong, about 4. mm. long, shining dark blue, with deep brown or piceous antennae and yellow legs; thorax sparsely, elytra more coarsely and more densely punctate", of which the type was collected by Dr. Richard T. Cotton at Río Piedras on *Jussiaea suffruticosa*. Additional collections have been made on this host at Loíza, by Dr. Stuart T. Danforth at Yabucoa and on the margin of Cartagena Lagoon, and by Mr. E. G. Smyth at light at Guánica. Doubtless numerous other instances of occurrence have been unobserved because of the similarity of this species to *Altica occidentalis* Suffrian in color, approximate size and host, the most obvious difference being the color of the legs, those of the *Altica* being black.

Ectmesopus vitticollis is one local representative of "A New Genus of Galerucinae (Coleoptera) from the West Indies" described by Mrs. Doris Blake (Proc. Ent. Soc. Washington, **42** (5): 95–104, pl. 1, Washington, D. C., May 28, 1940), of which the type was collected at Ponce by Mr. R. G. Oakley on "hediondilla" (*Peiranisia polyphylla*). It is "from 3 to 4 mm. long, oblong oval, shining, reddish yellow, usually with piceous markings on occiput of head, a short vitta on either side of prothorax, a dark line along edge of fermora and tibiae, and blue or violet elytra, breast and abdomen more or less dark. Antennae of male with 10th joint much enlarged".

Ectmesopus zonatus Blake (1940–100) was collected by Dr. P. J. Darlington in the Maricao Forest at an elevation of 3,000 feet. It is "about 3.5 mm. long, oblong oval, shining yellow brown, with piceous occipital band running behind eyes and a piceous vitta on either side of the prothorax; elytra with the base and apical half lustrous green, and irregular pale yellow brown band in middle, femora with a piceous streak on edge". Both species are presumably rare, as no other collections are known.

Cerotoma ruficornis Olivier (1791–200), of which the type was from the French West Indian island of Guadeloupe, has precedence over the name *Cerotoma denticornis* Fabricius (1792–24), of which the type is from Venezuela. It is under the latter name, however, that Drs. Stahl and Gundlach list this bright red and black pest of beans in Puerto Rico, despite the correct synonymy given by Weise. For the numerous individuals lacking the two irregular black bands across the middle of the elytra, Weise (1885–157) proposed the varietal name **blandula.** At Río Piedras, Mr. E. G. Smyth noted that these "semi-immaculate adults occur 1 to 5 of the normal form". The name *Cerotoma trifurcata* Forster, unfortunately used by Dr. C. W. Hooker (1913–34), refers to this species, and should not be considered a distribution record for the continental species, which does not occur in Puerto Rico. In addition to the early

records on beans, cowpeas and squash, this beetle has been collected on lima beans, and, if not feeding, at least resting on sweet potatoes, cucumber, peppers and sugar-cane. It occurs in abundance in all the coastal regions of Puerto Rico, in all the other Greater Antilles and in most of the Lesser Antilles, as well as in northern South America, Central America and Mexico. In most of these countries it is presumably an introduced species, for it has not been found on Mona, Desecheo, Culebra or Vieques Islands.



The Bean Chrysomelid Beetle, *Cerotoma ruficornis* Olivier: 1, adult, 2, pupa, 3, larva, all about six times natural size; 4, egg, and detail of sculpturing on egg-shell, greatly enlarged. (Drawn by R. T. Cotton.)

Dr. Richard T. Cotton made careful studies on its life-history, publishing (1916–95) illustrations of all stages and recommendations as to methods of control. Since the advent of DDT, the latter are somewhat dated, for 3% DDT dust is very effective in control, entirely avoiding the possibility of injury to host by arsenicals. He found that the female beetles lay their eggs in the soil around the roots of the host plant. "They are a deep yellow in color when first laid, but soon change to a dark reddish-brown. They are eliptical in form, with a surface roughened with small hexagonal pits.

Length 0.6 mm., width 0.3 mm. The eggs hatch at the end of eight days, and the emerging larvae, almost white in color, begin at once to feed on the roots of beans. The larvae feed for a period of from twenty-five to thirty days before pupating. When mature they are white in color, slender, tapering gradually from the head caudad. Head, thoracic and anal plates black, the anal segment with a fleshy proleg. Length 8.0 mm., width 1.0 mm. The pupal stage lasts for a period varying from five to eight days, depending on weather conditions. The pupa is white in color, slender, naked, and furnished with a few scattering hairs. Length 3.5 mm. The beetles may be controlled by collecting them when they first appear and their numbers are few. A small cheese-cloth net may be used for this purpose, and as the beetles are quite sluggish in their movements, they are easily captured and destroyed". Rather surprisingly, Dr. Alex. Wetmore identified none of these beetles in the stomach content of the birds he examined, but Mr. D. W. May noted that they had been eaten by the newly introduced Surinam toad, and they have been found in the stomach of the little grass lizard, *Anolis pulchellus*.

Asbecesta violacea Allard, an Old World species, occurs in Cuba, and in Puerto Rico has been found only at Guánica, collections having been made there by Dr. Stuart T. Danforth, and by Mr. R. G. Oakley on "abeyuelo", *Colubrina ferruginosa*.

Phyllotreta fallaciae Csiki, listed from Puerto Rico by Weise and Dr. Gundlach as *P. fallax* Suffrian, has not since been collected here.

Phyllotreta guatemalensis Jacoby, as determined by Mr. G. E. Bryant and confirmed by Mr. A. J. Mutchler, was found at Mayagüez in enormous numbers on "jazmín de río" *Cleome, gynandra*, and *C. spinosa*, by Rev. R. E. Danforth, the father of Dr. Stuart T. Danforth, in February 1923. They were later noted at Mayagüez in February 1931, and repeatedly since, the only other record being at Coamo in April 1928. Dr. Alex. Wetmore found them eaten by the tody and the cliff swallow. These beetles are about 2.0 mm. long, with dark blue-green head, prothorax and elytra dark blue, evenly and densely punctured, the body black to blue-black in color.

Aphthona auripennis Suffrian, as determined by Mrs. Doris Blake, has been collected by Dr. Stuart T. Danforth at Tortuguero Lagoon, at Manatí on crotalaria, at Juana Díaz and at Mayagüez. Prof. J. A. Ramos (1947–43) found "adults very numerous, feeding on the leaves of *Stigmaphyllon lingulatum*" on Mona Island.

Aphthona compressa Suffrian, which Herr Weise (1885–162) notes "variirt in der Grösse auserordentlich (von 2–4 mm. Länge, und 1.2–2.5 mm. Breite)", also appears to vary considerably in coloring, its prothorax being bright orange to red, and its elytra blue or purple. After

studying all the specimens in the Río Piedras collection, and many others, Mrs. Doris Blake proposes the name *Homoschema*: "A New Genus of Flea-Beetles from the West Indies" (Psyche **57** (1): 10–25, pl. 2. Cambridge, March 1950).

Homoschema latitarsum Blake (1950–16), TYPE from Maricao Forest, others from Indiera and Adjuntas, occurs only in the mountains of Puerto Rico, other collections having been made on coffee at Utuado and Maricao.

The TYPE of the dark-breasted **Homoschema nigriventre** Blake (1950–18) is from Ponce, intercepted by Mr. R. G. Oakley, others from Parguera, San Germán, Manatí, Algarrobo, Sardinera and Río Piedras, also from Mona Island, St. Thomas and St. Croix, U.S.V.I., 2.5 to 3 mm. long, 1.5 mm. wide, with violaceous elytra. **Homoschema fraternum** Blake (1950–19), the TYPE from San Juan, has a narrower aedeagus.

Homoschema obesum Blake (1950–22), the TYPE from El Vigia, Ponce, intercepted by Mr. R. G. Oakley, others from Yauco, Boquerón, Mayagüez, and Algarrobo, 3.2 to 4 mm. long, 2 to 2.8 mm. wide, also with violaceous elytra, is not to be distinguished from the others on the basis of host preference, for all coastal species have been taken on "bejuco de toro", *Stigmaphyllon* (or *Stigmatophyllum*) *tomentosum*, "bejuco de buey", *Banisteria laurifolia*, and other Malpighiaceae.

Aphthona maculipennis Jacoby is a smaller brown beetle with two lighter spots on each elytron. Mr. Thos. H. Jones collected adults feeding on the leaves of *Phyllanthus lathyroides* at Río Piedras, as identified by Dr. E. A. Schwarz. Others collected by Mr. R. G. Oakley on *Myrcia cerifera* at Guánica may be this species.

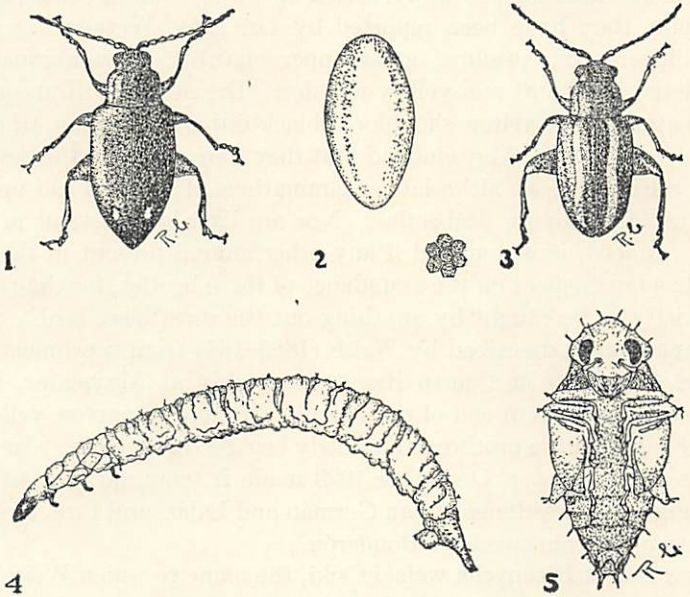
The Cuban *Longitarsus seminulum* Suffrian, as identified by Mr. G. E. Bryant, is a small brown Chrysomelid swept from grass in a salty waste at Salinas.

Longitarsus varicornis Suffrian, a small brown fleabeetle of extended distribution, found in the Gulf Coast States, Mexico and Central and northern South America, as well as in Cuba and Puerto Rico, was noted by Weise (1885–162) and listed by Dr. Gundlach. At times it may occur in enormous abundance, as on *Heliotropium indicum* at Río Piedras and Caguas, on *Psidium guajava* at Coloso, and on tomatoes at Villalba, hosts botanically as widely separated as the localities were geographically where the outbreaks were noted. Specimens from Mona Island, collected by Prof. J. A. Ramos at light, were undetermined as to species by Mr. H. S. Barber.

Dr. Alex. Wetmore reports finding the remains of a fleabeetle identified as a species of *Glyptina* in the stomach contents of a tody, *Todus mexicanus*, but nothing corresponding to this had previously been reported or has since been collected.

Systena basalis Jacquelin-Duval, "La Pulga Americana" of Puerto Rican tobacco growers, is merely listed by Weise, but Dr. Gundlach notes,

"ambos sexos difieren mucho", or, more correctly, the sexes differ considerably from each other. Altho both are generally piceous with greenish luster, the males are smaller and each elytron has a broad median longitudinal golden stripe; the females have faint basal and apical spots on the elytra. Dr. Stahl lists this species as *Haltica basilea* Jacq., and possibly during his lifetime it was not an economic pest of tobacco, for Mr. O. W. Barrett, the first Entomologist at the Mayagüez Station, noted (1904–448) it only on Russian sun-flower. To be sure, it does occur on many other hosts than tobacco, Mr. R. H. Van Zwaluwenburg listing beans, okra and beets, and it is often noted on sugar-cane, but most plants on which it



"La Pulga Americána," *Systena basalis* J. Duval: 1, adult female, 3, adult male, 4, fully-grown larva, 5, pupa; all from eight to ten times natural size, 2, egg, greatly enlarged. (Drawn by R. T. Cotton.)

feeds are solanaceous: eggplant, potato and tomato. Anyone attempting to grow temperate zone garden flowers may find few to many beetles feeding on them; marigold, dahlia, coreopsis, everlasting and others having been noted as attacked.

The list of other observed hosts includes squash, carrots, sweet potato, *Solanum indicum*, *Phaseolus aurens*, *Arracasia xanthorrhiza*, *Portulaca oleracea*, *Valerianodes cayennense*, *Verbesina alata*, *Pluchea odorata*, *Lantana camara*, *Bidens pilosa*, *Synedrella nodiflora*, and *Moluchia tomentosa*, any one of which may be the principal, rather than merely an alternate host plant. The beetle occurs in other of the Greater Antilles, in Cuba

being possibly most abundant during the autumn on the common sunflower, *Helianthus annuus*, feeding on the tender leaves of young plants, but not an economic pest on tobacco or cotton. It was one of the "Common Insect Pest (which) prefer other Host Plants in Haiti" (Jour. Ec. Ent., **20** (2): 429. Geneva, April 1927), cotton being the crop attacked there. Mr. C. C. Gowdey does not even list it in his "Catologus Insectorum Jamaicensis" of 1926, altho it is known to occur there. Dr. Richard T. Cotton made life-history studies, publishing (1916–90 to 93) illustrations of all stages, a list of host plants and recommendations as to methods of control. Possibly because the elytra of these beetles are so characteristic and could be identified so easily, mixed up with the other contents of birds' stomachs, they have been reported by Dr. Alex. Wetmore as eaten by the killdeer, cliff swallow, grasshopper sparrow, mozambique, yellow-shouldered blackbird and yellow warbler. Dr. Stuart T. Danforth found them eaten by the yellow-shouldered blackbird and by the northern water thrush. Mr. D. W. May claimed that they were eaten by the newly introduced Surinam toad, altho later examinations of its food did not include these rapidly moving fleabeetles. Nor are lizards successful in catching them. Indeed, it is doubtful if any other animal present in the environment has much effect on the abundance of these beetles, for they disappear too swiftly to be caught by anything but the most alert bird.

Systena varia, described by Weise (1885–164) from specimens collected by Dr. Gundlach in Puerto Rico, presumably at Mayagüez, is known only from the western end of the Island. It has two narrow yellow bands on each elytron, the prothorax and body being a dull yellow. An outbreak of these fleabeetles in December 1923 made it temporarily a serious pest on young cotton seedlings at San Germán and Lajas, and Prof. J. A. Ramos later swept it from weeds at Boquerón.

Specimens of **Disonycha weisei** Csiki, the name to which Weise's "nigrocoerulea" *pallipes* (1885–159) is now referred, have not been found in Puerto Rico since Dr. Gundlach's original collection.

Disonycha spilotrachela, described by Mrs. Doris Blake (Bull. Brooklyn Ent. Soc. **23** (2): 93–98. Brooklyn, April 1928) with the type from Haiti, others from Tortuguero Lagoon, Puerto Rico, is "brown, pronotum 5–7 spotted, elytra with a common sutural vitta uniting with narrow submarginal one, a discoidal median vitta on either elytron not reaching apex". Besides the type which Dr. Stuart T. Danforth had collected on the shores of Tortuguero, he had others from Aguadilla, and Prof. J. A. Ramos found it at Faro de Cabo Rojo.

Disonycha chlorotica Olivier is listed from Puerto Rico by Weise and Drs. Stahl and Gundlach. Of specimens recently collected at Adjuntas, Mr. H. S. Barber gives the doubtful identification of the Guadeloupe

Oxygona pallens F., noting that "a closely related Cuban specimens has been labeled *Disonycha chlorotica* Oliv., but can hardly be that species". Dr. Stuart T. Danforth had specimens from Maricao and Mayagüez identified as *Oxygona pallens* F., presumably by Mr. A. J. Mutchler. Other specimens to which these names have doubtfully been assigned were collected on sweet potato at Villalba and on *Cacara tuberosa* at Ponce.

The Cuban **Disonycha interstitialis** Suffrian, a yellowish-brown, densely punctured fleabeetle listed by Weise and Dr. Gundlach, has since been found on "roble" (*Tabebuia pallida*) and on *Jasminum sambac* at Bayamón, on *Quercus thompsonii* at Ponce, and, without host records, at Mayagüez, Aguada, Orocovis and Guánica.

To specimens now lost, Dr. Stahl had assigned the name *Disonycha ambulans* Suffrian.

Disonycha eximia Harold, the presently accepted name for what Mr. G. E. Bryant identified as *Disonycha laevigata* Jacoby, occurs in northern South America, Central America and some of the West Indies. It is a bright orange-red fleabeetle; the eyes, antennae except two basal segments, apical half of tibiae and all of tarsi, black and finely pubescent; elytra bright green, shining, impunctate, which when first found in Puerto Rico, occurred in such enormous numbers as to be reported as "An Important New Pest of Beets in Porto Rico" (Jour. Ec. Ent., **16** (5): 459–460. Geneva, June 1924). Concerning it, the Rev. R. E. Danforth made "Notes on the Life-History of *Disonycha laevigata* Jacoby in Porto Rico" (Jour. Ec. Ent., **17** (3): 415–416. Genera, June 1924). The first record in Puerto Rico of this beetle is in August 1921, feeding on the foliage of the weed "bledo" or "blero", species of *Amaranthus*, in great abundance at Yauco and Guánica. At that time, during the cane grinding season, boats came at frequent intervals from La Romana, Dominican Republic, and it is possible that this is an introduced pest from Hispaniola, where it had been known because of its injuries to beets (at Haina, R. D., in 1920). By 1923 it had spread along the west coast to Mayagüez, where Mr. R. E. Danforth had recorded its abundance on "beets, chard, eggplant and many other vegetables", to Hatillo on the north coast, where the "yerba de sal" (*Philoxerus vermicularis*) on the beach was being eaten. Within a few years it was being intercepted on cucumbers at Bayamón, on beans and asparagus at Palo Seco, and on corn, peppers and cucumbers at Loíza, and on the weed "jamón con huevo" (*Achyranthes bettzickiana*). Dr. Stuart T. Danforth had specimens from Utuado, Juncos, Humacao and Ponce, indicating a dispersion to all parts of the Island. He found the remains of this beetle in the stomach contents of an ani at Cartagena Lagoon. It is also recorded as being eaten by the crested lizard, but is possibly too active to be often caught by the introduced toad. The enormous numbers noted resting

on pineapple at Arecibo presumably followed the elimination of "bledo" by weeding, comparable to a similar abundance on beans and sugar-cane at Guánica following weeding, and indeed all records on other than plants of the Chenopodiacea and Amaranthacea may be considered as accidental. Injuries to beets may not come at all, or may not develop until an abundance of foliage has formed, but instances have been noted of attack on the first tender leaves of seedlings just a few inches high. Such young seedlings must be mechanically protected with cold frames or wire screens, if they are to get a start in a region where, or at a time when these beetles are numerous. It is possible that DDT sprayed on the soil surrounding may kill the beetles attacking very small plants, but this has not been tested in the field.

Lactica megaspila was described by Mrs. Doris H. Blake as one of "Seven New Flea Beetles from the West Indies (Coleoptera-Chrysomelidae)" (Psyche, **55** (3): 141–149, pl. 1. Cambridge, September 1948) from collections made by Mr. Carlos M. Matos at Villalba in June 1934. It is 3.1 mm. long, 1.6 mm. wide, "oblong ovate, shining, yellow brown, antennae with the outer joints dark, elytra with four large dark spots having a greenish lustre, two at base and the other two at the apex of the elytra."

Altica jamaicensis F., one of the largest and most abundant of fleabeetles in Puerto Rico, is iridescent dark blue in color, all stages of which, except the pupal, one may expect to see on plants of the various species of *Jussiaea*. Correctly listed by Weise, with *Haltica plebeja* Olivier in synonymy, Dr. Gundlach uses Olivier's name, and notes that the beetles are "común en Cuba". Dr. Richard T. Cotton, in reporting on the "Life-History of *Haltica jamaicensis* Fabr." (Jour. Dept. Agr. P. R., **1** (3): 173–5. San Juan, July 1917), notes that the adults may also survive feeding on the foliage of garden beans; the females lay from 500 to 800 eggs on the leaves of the host plant, pupae are formed in the ground, and the total period from egg to adult is 39 days. The killdeer, tody and cliff swallow were noted by Dr. Alex. Wetmore to have fed on these beetles, and Dr. Stuart T. Danforth found them eaten by the golden warbler and the northern water thrush. They occur on the host plants wherever present, from near the coast to high on El Yunque, those living in the mountains being somewhat larger than those found at sea-level. Exceptionally, these beetles may be found feeding on the leaves of other than the normal host plants: dozens on crape myrtle (*Lagerstroemia indica*) at Río Piedras, several on "mangle" (*Laguncularia racemosa*) near Laguna San José, or resting on seagrape at Guanajibo Dam, on ñame or wild eggplant at Mayagüez.

Altica occidentalis Suffrian feeds on the foliage of all of the various species of *Jussiaea*, and is exactly the same color of iridescent blue as

A. jamaicensis, but is much smaller. From the very similar, yellow-legged *Luperodes antillarum* Blake, which is of the same size, it may be readily distinguished by its black legs. Listed by Weise and Drs. Stahl and Gundlach, it has most recently been attentively observed by Prof. James G. Needham, who, in studying the "Insects from the Seed Pods of the Primrose Willow, *Jussiaea angustifolia*" (Proc. Ent. Soc. Washington, **43** (1): 2–6, fig. 6. Washington, D. C., January 1941), noted that the female "lays her eggs by twos and threes at the end of the pods". Mr. E. G. Smyth found the adults coming to light at Guánica, and they have also been found resting on leaves of sugar-cane there, as well as at Toa Baja and at Bayamón, and on Vieques Island. In September 1935, the tender leaves of a hedge of crape myrtle (*Lagerstroemia indica*) at Río Piedras, were attacked by these beetles, and some of *Luperodes antillarum* Blake, while a month later, when a fresh crop of new leaves was put forth, a few of *Altica jamaicensis* also appeared to share them with the smaller beetles.

Of **Altica rufa** Illiger, listed by Weise and Dr. Gundlach as *Lactica scutellaris* Olivier, Dr. Stuart T. Danforth had specimens, as determined by Mr. A. J. Mutchler, from Adjuntas, Villalba and Mayagüez. The adults are bright red in color, the females laying orange-colored eggs on the leaves of *Trema micrantha* at Indiera, in the mountains north of Yauco. These fleabeetles are not confined to the mountains, however, as individuals have repeatedly been swept from weeds and grass at Río Piedras, and others have been collected on eggplant at Arecibo.

No specimen of the Cuban **Altica gravidula** Suffrian, listed by Weise, has been found in Puerto Rico since the original collection by Dr. Gundlach.

Mr. H. S. Barber has identified some beetles collected on coffee and banana at Ponce, and from the postoffice hedge of "café de la India" (*Chalcas* or *Murraea exotica*) in San Juan as being a species of *Altica* near *pupurascens* Suffrian, and others as **Altica liturata** Olivier. A small elongate blue-black beetle with purplish and greenish reflections, collected on Mona Island by Prof. J. A. Ramos, he considered to belong to a "genus near *Altica*, *Hermaeophaga* or *Syphrea*, probably new".

Dicoelotrachelus violaceus was described by Mrs. Doris Blake from Puerto Rico as one of "Six New Species of West Indian Chrysomelidae" (Proc. Ent. Soc. Washington, **50** (5): 121–7, pl. 1. Washington, D. C., May 1948), the type having been collected at Ponce by Mr. R. G. Oakley. It is "about 3.0 mm. in length, oblong, shining; antennae, head, thorax, scutellum and legs reddish or yellowish brown; elytra violaceous, undersurface brown; thorax with a deep transverse sulcus across the middle."

Glyptobregma cyanellum was described by Mrs. Doris Blake (1948–126) from types collected by Mr. R. G. Oakley on "bejuco de corrales" (*Seriania polyphylla*) in the mountains north of Ponce, and on the leaves of other

plants there and at Adjuntas. It is "from 2 to 3 mm. in length, broadly oblong oval, lustrous blue-violet or sometimes with a blue-green thorax; the antennae, lower part of face, legs and undersurface brownish or yellowish; thorax at the base about the same width as the elytra".

Glyptobregma portoricense, described by Mrs. Doris Blake as belonging to "A New Genus of Flea Beetles from the West Indies" (Jour. Washington Academy of Sciences, **37** (3): 92–95, fig. 5. Washington, D. C., March 15, 1947), is "about 3–4 mm. in length, oblong oval, pale yellow brown, the elytra tending to be a little darker, faintly shining, eyes very large, thorax irregularly and coarsely punctate, elytra semicostate between the partly geminate rows of punctures". Its enormous eyes nearly meet at the vertex. The type was intercepted by Mr. R. G. Oakley at Ponce on *Quercus thompsonii*, others on this host are from Orocovis, and collections have also been made at Bayamón, San Juan and Guánica, on other trees or with the host not recorded.

Pseudoepitrix hoffmani described by Mr. G. E. Bryant (Ann. & Mag. Nat. Hist., **20** (118): 446. London, 1927) for Dr. W. A. Hoffman of the School of Tropical Medicine, who collected the type material, has since been found at Mayagüez, Las Marías and Aguadilla. It is "elongate, light yellow brown, shining, about 2.0 mm. long, with rather prominent eyes", and "the groove behind the tubercles is an inverted V", according to Mrs. Blake (1941–175).

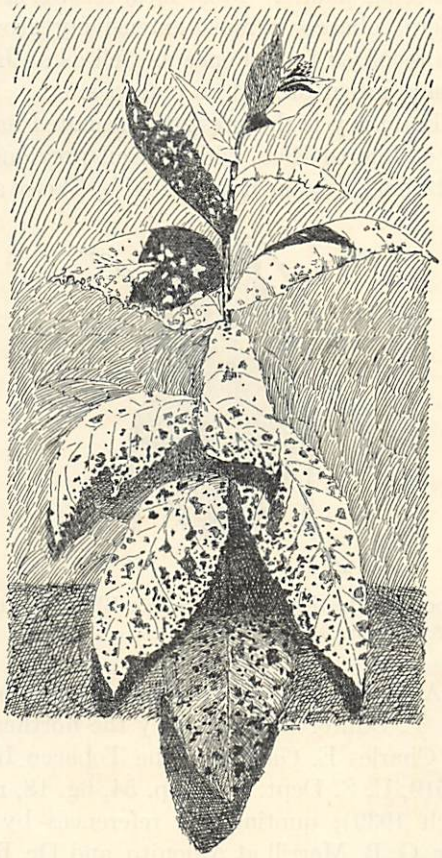
Millions of iridescent blue fleabeetles about 3.0 mm. long, elytra very minutely punctured, were found resting on the leaves of an unidentified tree on a hill northeast of Guayama, January 23, 1922. Described by Mr. G. E. Bryant (Ann. & Mg. Nat. Hist., **13** (9): 302. London, 1924) as a species of *Haltica*, these are now known under the name of **Hermaeophaga cubana** Bryant, altho the type is from Puerto Rico, and, so far as is known, no additional specimen has been collected here or anywhere else.

Hermaeophaga cylindrica, described as a *Haltica* by Weise (1885–160) and thus listed by Dr. Gundlach, is a somewhat more slender, greenish iridescent fleabeetle, repeatedly collected since on "yerba bellaca" (*Croton humilis*) and other wild crotons, often skeletonizing the leaves when they are abundant. It has been noted at Ponce, Yauco, Guánica, Mayagüez and Guajataca, and presumably it is this species which occurs on wild crotons on Mona Island.

Crepidodera asphaltina Suffrian, originally described from Cuba, was collected by Dr. Gundlach in Puerto Rico, and discussed by Weise. It has since been found on squash at Vega Baja, on pepper at Loíza, and Dr. Stuart T. Danforth had specimens from Barranquitas, as determined

by Mrs. Doris Blake. Presumably it was to specimens of this species to which Dr. Stahl applied the name *Crepidodera hirtipennis* Melsheimer.

Epitrix cucumeris Harris, "La Pulga Negra" of Puerto Rican tobacco growers, is the most common and troublesome of the fleabeetles attacking tobacco. It also feeds on other Solanaceous plants, such as potatoes, tomato and eggplant, both cultivated and wild. After Dr. Richard T.

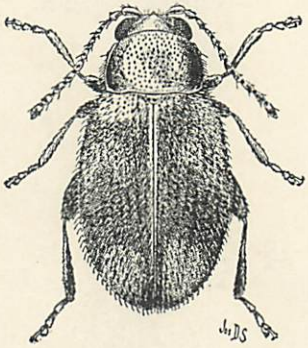


Flea Beetle Injury to Tobacco. (Drawn by Francisco Seín.)

Cotton had worked out its life-history (1916–87), publications by Mr. J. D. More on "Las Pulgas del Tabaco" (Circ. No. 50, Est. Expt. Insular, pp. 8, fig. 3. Río Piedras, October 1921), and by Mr. Luis A. Catoni on the "Plagas de Insectos que atacan la Planta del Tabaco" (Revista Agr. P. R., **7** (5): 45–50. San Juan, 1921) discussed the economic aspects of its presence, and methods of control. Since the advent of DDT as an

insecticide, these have been revised, at least for protecting the younger plants. Indeed, since DDT is less poisonous to human beings than arsenate of lead, its use even on the maturing leaves is to be recommended. Dr. Gundlach and Weise gave only the name *Epitrix fuscata* DuVal for this little black fleabeetle, over which Harris' name has the priority, regardless of its being so inappropriate for a pest which in Puerto Rico attacks only Solanaceous plants. Most local records are from the interior of the Island, where tobacco is most extensively grown, but it occurs everywhere, and is recorded from Ponce as well as at Jájome Alto, where it was almost the only insect present on potatoes.

Epitrix fasciata Blatchley is the presently accepted name for the brown tobacco fleabeetle of Puerto Rico, which in all previous records is called *Epitrix parvula* Fabricius. As such it is listed by Weise and Dr. Gundlach,



The brown Tobacco Flea Beetle, *Epitrix fasciata* Blatchley, twenty times natural size. (After Morgan & Gilmore.)

mentioned by Dr. Alex. Wetmore as having been eaten by the cliff swallow and by Dr. Stuart T. Danforth as eaten by the northern parula warbler, as well as by Dr. Charles E. Gage in "The Tobacco Industry in Puerto Rico" (Circ. No. 519, U. S. Dept. Agr., pp. 54, fig. 18, ref. 11. Washington, D. C., March 1939), quoting the references by Mr. R. H. Van Zwaluwenburg, Mr. G. B. Merrill at Aibonito, and Dr. Richard T. Cotton. It is a somewhat less abundant species than the black tobacco fleabeetle, and is less specialized in its hosts, sometimes being noted in abundance on the leaves of sugar-cane, but not eating them, and Dr. Cotton found it "on *Cleome spinosa*, *Leptilon canadense*, *Lycopersicon esculentum*, *Solanum nigrum*, *Solanum torvum*, tomato and eggplant", and it is recorded from *Physalis angulata* and potato.

Very few Puerto Rican tobacco growers have departed from their accustomed practise of using arsenate of lead or Paris green for the control

of all insects attacking the leaves of tobacco, despite the fact that many new and more desirable insecticides are now available. To date, no experiments have been conducted locally to test even DDT. In consequence, no recommendations can be made as to the effectiveness of this, lindane, the Hyman products and many others, despite the presumption in their favor. The same or similar fleabeetles on potatoes in the States, and the common potato beetles and leafhoppers are ever so much more effectively controlled by DDT and the other new insecticides that average yields have almost doubled. The same effect is hardly to be expected in Puerto Rico on tobacco, but the cost of control might be considerably decreased if more effective insecticides were generally used.

Heikertingerella krugi, which Weise (1885–163) described as a *Homophyla*, is "ovali-hemosphaerica, testacea, nitida, pectore femoribusque posticis brunneis, prothorace elitrisque parce subtilissimeque punctulatis, fere laevibus, long 2. mm.". Dr. Stuart T. Danforth had specimens, as determined by Mrs. Doris Blake, from Matrullas, Villalba and Aibonito, but it is not confined to the mountains, for Prof. J. A. Ramos collected it at Mayagüez and San Germán, as did Mr. R. G. Oakley at Ponce.

Podagrica cyanipennis Weise, as determined by Mr. H. S. Barber, was intercepted on *Volkameria aculeata* at Ponce by Mr. R. G. Oakley. This was described by Weise (1885–165) from the nearby island of St. Thomas as "ovata, convexa, rufa, nitida, antennis infuscatis, elytris laete cyaneis, minus subtiliter punctulatis, ponehumeros transversim impressis, long 4. mm."

Chaetocnema apricaria Suffrian is an exclusively Cuban species, according to Mrs. Doris Blake, who, in describing "New Species of *Chaetocnema* and other Chrysomelids (Coleoptera) from the West Indies" (Proc. Ent. Soc. Washington, **43** (8): 171–180, pl. 1. Washington, D. C., November 29, 1941), attempts to "straighten out the identity of the species of the *Chaetocnema* in the West Indies that in the past have been labeled indiscriminately as *C. apricaria* (Suffrian)". Listed as a *Plectroscelis* by Weise, and by Drs. Gundlach and Stahl, the Puerto Rican material is divided by her among four distinct species.

Chaetocnema brunnescens Horn, collected originally at Key West, Florida, by Dr. E. A. Schwarz, presumably on mangrove, is primarily a West Indian species, found in the Bahamas, and along the coast of Hispaniola, Puerto Rico and St. Thomas. The brownish curved slits so often noted on the underside of the leaves of mangrove (*Rhizophora mangle*) are due to the activities of this species, definitely recorded from Laguna San José, Martín Peña, Dorado and Mayagüez, and by Dr. W. A. Hoffman on Santiago Island at Humacao Playa. Similar injury to "rosa de ciénaga"

(*Ginoria rohrii*) was observed at Boquerón in May 1923, when the adults were present in great abundance, and noticeably not very active in jumping away when disturbed. At the time, Dr. E. A. Schwarz was of the opinion that this beetle was not responsible for the injury, and that it did not feed on the plants on which it was found. Mrs. Blake definitely identifies it as the same species which he collected at Key West: "paler brown; a greenish metallic lustre and a conspicuously punctate head, larger and more elongate than the other West Indian species".

Chaetocnema elachia, "a much smaller species, very tiny, with a very much more finely punctate thorax", is described by Mrs. Blake as "oblong oval, about 1.5 mm. long, shining deep brownish black, with legs (except the dark hind femora) and antenna paler, elytra not depressed" from material collected by Mr. August Busck on Vieques Island in February 1899. It is also recorded from Río Piedras, collected by Mr. Thos. H. Jones on wild morning glory, and to this species may possibly be referred those fleabeetles sometimes found in almost destructive abundance on the leaves of sweet potato.

Chaetocnema perplexa Blake, is also often taken on *Convolvulus* elsewhere than in Puerto Rico, and occurs in Bermuda, Cuba and Hispaniola, the only specimen of this *confinis* group, as identified by her, from Puerto Rico being one intercepted by Mr. R. G. Oakley at Ponce on tomato leaf.

Chaetocnema laticeps Blake, of which the type is from Trou Caiman, Haiti, has been collected at Guánica Lagoon. It has an "unusually broad head and wide interocular spaces, as well as punctate upper and lower surface," according to Mrs. Blake.

Chaetocnema nana Jacoby, as determined by Mr. G. E. Bryant, was found in great abundance on grass growing in salty land near Salinas in August 1921.

As to all the other records from Puerto Rico: on squash at Guaynabo, on cassava at Loíza, on tomato at Jayuya, on *Guilandina crista* and *Scirpus validus* at Ponce, on *Volkameria aculeata* at Boquerón, of being eaten by the lizard, *Anolis krugii*, and Dr. Wetmore's records of being eaten by the ani, the yellow and parula warblers, only re-examination of material will indicate to which species of *Chaetocnema* each should be assigned.

Blepharida irrorata Chevrolat, listed by Weise and Dr. Gundlach, has since been collected on *Matayba* at Ponce by Mr. R. G. Oakley.

Omophoita albicollis Fabricius, a very active brown fleabeetle, with bright yellow pronotum and five yellow spots on each shining brown elytron, is probably what Weise and Dr. Gundlach list as *Oedionychis 10-guttata* Fabricius. Dr. Stahl gives the name *Oedionychis aequinoctialis* F., Dr. E. A. Schwarz identified specimens as *Homophoeta aequinoctialis* Fbr., and Mr. C. A. Frost as *H. equinoctialis* L. The specimens from

Belém do Pará, Brasil, identified by Mr. G. E. Bryant as *Homophoeta aequinoctialis* L., and those from British Guiana have the central yellow spot on the elytra oval; on all those from Vieques Island and Puerto Rico it is a narrow transverse band: an obvious difference between two similar species with similar continental distribution, of which *albicollis* only occurs in the West Indies. Wild heliotrope (*Heliotropium* or *Tiaridium indicum*) was found heavily infested by these beetles at Caguas by Dr. Richard T. Cotton, and Mr. F. Seín noted the same host being eaten at Boquerón. As this is a common weed in cultivated land, records of the beetles resting on sugar-cane and other plants at many localities in various parts of the Island are to be expected.

Omophoita cyanipennis Fabricius is very striking in appearance because of its dark iridescent blue elytra, most of the rest of the beetle, including its greatly enlarged hind femora being yellow in color. It occurs in all the Greater Antilles, and in St. Thomas and St. Croix, but has not been found on Vieques, Culebra or Mona. Listed as an *Oedionychis* by Weise and Dr. Gundlach and Dr. Stahl, the habits of the female have recently been noted by Prof. James G. Needham (1941–5) as she "lays her eggs in clusters of a dozen or more on the underside of the leaves" of the primrose willow, *Jussiaea angustifolia*. Adults have also been found on other species of *Jussiaea*, but Mr. E. G. Smyth considered them "general feeders, on *Verbesina*, *Valerianodes*, *Pluchea*, *Physalis* and other plants". Repeatedly noted resting on leaves of sugar-cane, they were in such abundance on the leaves of mangrove at Laguna San José near Río Piedras, and on *Volkameria aculeata* at Boquerón as possibly to indicate these latter as true host plants.

Oedionychus bicolor Linnaeus, superficially similar in general appearance to *Omophoita cyanipennis*, is somewhat shorter, its elytra are a lighter and somewhat greenish blue, as are also its distended hind femora. According to Mrs. Blake (1940–173), "it occurs in Puerto Rico, and the Virgin Islands (St. John, St. Thomas, St. Croix, Virgin Gorda)", the records from Cuba and Hispaniola referring to other species. The French Botanist Ledru (1780) refers to this beetle in Puerto Rico under the generic name of *Altica*, and Weise and Dr. Gundlach as an *Oedionychis*. In March 1923, it was found in great abundance at Pt. Salinas (between Palo Seco and Toa Baja) on *Volkameria aculeata*, the other records being on unidentified hosts at Laguna San José and at Dorado. Its very limited distribution in Puerto Rico, practically confined to the San Juan area, has been modified by a single record at Ponce by R. G. Oakley, and others at Guánica by Prof. J. A. Ramos.

Oedionychis decemguttata Fabricius, listed by Weise and Dr. Gundlach,

has not since been found in Puerto Rico, and it may be presumed that their record refers to *Omophoita albicollis* Fabricius.

Hadropoda morrisoni, the most abundant of the seven "New Species of *Hadropoda* Suffrian from the West Indies" (Bull. Mas. Comp. Zoölogy, **92** (8): 413–41, pl. 4. Cambridge, August 1943) described by Mrs. Doris Blake from Puerto Rico, is presumably what Dr. Gundlach listed under the name *Hadropoda ferruginea* Suffrian. The type is from Maricao, and altho most collections have been made in the mountains, at Adjuntas, Corozal, Cidra, and at Indiera in the mountains above Yauco, Mr. A. S. Mills found individuals on the coast at Loíza Aldea. These beetles were so abundant in the summer of 1941 at Aguas Buenas as to completely destroy rose bushes, but this is the only host record. They are "about 2 mm. in length, oblong oval, faintly shining under the fine, closely appressed, pale pubescence, pale yellow brown with two apical joints of the antennae and a median elytral spot, dark brown".

Hadropoda barberi Blake (1943–440) is a short, plump species, 2 mm. long, with oval elytra, wingless, the type from Villalba and others from Adjuntas on areca "palm" (*Areca catechu*), collected by Mr. R. G. Oakley.

Hadropoda eugeniae Blake (1943–422) is exceptionally large, 4.5 mm. long, with raised spots on the elytra like warts, and a "dense curling pubescence", the type collected by Mr. R. G. Oakley on "pomarrosa" (*Eugenia jambos*) at Indiera in the mountains above Yauco.

Hadropoda rugosa Blake (1943–427), the type from El Yunque, collected by Dr. P. J. Darlington, is 3.5 mm. long and has fewer pronounced warts.

Hadropoda oakleyi Blake (1943–422) is named for the "interceptor" of the type. It is "between 2 and 3 mm. in length, finely pubescent, pale yellow brown, with numerous dark elytral spots". It was collected on "pomarrosa" (*Eugenia jambos*) at the Natale finca in the mountains above Yauco.

Hadropoda tabebuiae Blake (1943–437), 3 to 4 mm. long, of which most specimens were from coffee groves near Adjuntas or on "roble" (*Tabebuia pallida*) in the mountains above Ponce, is of very variable depth of coloration, "some being nearly piceous, while others are pale, some have a dark thorax and pale elytra, while others have a pale thorax and dark elytra. The dense golden pubescence is particularly noticeable in dark specimens".

Hadropoda varicornis Blake (1943–423), 2.7 mm. long, has "spotted elytra combined with varicolored antennae". The type was collected by Mr. R. G. Oakley on *Ocotea* at the Torres finca, in the mountains above Ponce.

Ochthispa loricata, described by Weise (1885–166) from specimens collected by Dr. Gundlach, presumably at Mayagüez, is an elongate, reddish-brown Chrysomelid with the outer humeral and apical angles of its quad-

rangular elytra expanded into prominent horns. Adults "were very common near Macuto, Venezuela, feeding on sea-grape leaves", as reported in "Notes on the Insects of the Sea-Grape, *Coccoloba uvifera* (L.) Jacq., in Porto Rico" (Jour. Ent. Research, **17** (1): 49–52, ref. 6. London, July 1926), but only recently have they again been found in Puerto Rico: at Mayagüez by Dr. H. L. Dozier, and by Mr. L. Courtney Fife, in 1935.

The specific name of **Hilarocassis exclamationis** Linnaeus is suggested by the narrow, interrupted black band on the disc of each elytron of this large, straw-colored tortoise beetle: the largest occurring in Puerto Rico. As a *Mesomphalia* it is listed by Weise and Dr. Gundlach, but in recent years it has been excessively rare. Dr. Alex. Wetmore found it in the stomach contents of a cuckoo, but it is not again recorded until an outbreak occurred in the summer of 1936 at Ponce, which was so noticeable that photographs of the insect were reproduced in "El Imparcial". Most of the adults collected at this time were resting on "higuereta" (*Ricinus communis*) and presumably this is the host, but no larvae were seen. For over a year thereafter, scattered adults were to be found in cane fields: at Guánica, Aguadilla and Manatí.

The type of **Aedmon sericellum,** described by Mr. Hamlet Clark in his "Catalogue of the Halticidae in the Collection of the British Museum" (p. 131. London, 1860), is from Puerto Rico. No specimen to which this name might be assigned has since been collected.

A single specimen of a small brown Chrysomelid found on swamp vegetation at Boquerón in May 1923 was determined by Mr. G. E. Bryant as **Hypolampsis inornata** Jacoby, a Mexican species not elsewhere known. Additional specimens of this genus, identified by Mr. H. S. Barber, as "near" this species, have subsequently been found by Mr. R. G. Oakley on a variety of hosts in southwestern Puerto Rico, and by Prof. J. A. Ramos at Adjuntas and Maricao.

Megistops fictor, described by Weise (1885–162) from specimens collected by Dr. Gundlach in Puerto Rico, is another small brown beetle, "long 3 mm., brunneus, elytris subtilissime granulato-punctatis, macula basali lineolisque 3 ante apice dilute luridis". Mr. R. G. Oakley has since found this beetle on "roble" (*Tabebuia pallida*) at Guánica.

Megistops liturata Olivier, as determined by Mr. H. S. Barber, was collected by Mr. R. G. Oakley on *Scirpus validus* and *Tabebuia pallida* at Ponce. It is probably this Hispaniolan species which Dr. Luis F. Martorell found on "cupey" (*Clusia rosea*) on Mona Island.

From *Mayepea domingensis* at Guánica, Mr. R. G. Oakley intercepted beetles identified by Mr. H. S. Barber as a species of **Argopistes.**

Chalepus sanguinicollis Linnaeus is a slender, elongate, blue-black beetle, 7–8 mm. long, with the base of elytra and pronotum red, found in Argentina

and Brasil, as well as in Cuba, Hispaniola, Puerto Rico, Vieques, St. Thomas, St. Croix and Grenada. It is listed by Weise and by Drs. Stahl and Gundlach as *Odontota axillaris* Duv., and numerous individuals have since been collected resting on a wide variety of plants in all the more humid parts of the Island. Prof. J. A. Ramos has most recently found it on Mona Island.

Chelymorpha multipunctata Olivier, listed by Weise and Dr. Gundlach and identified by Dr. E. A. Schwarz as *Chelymorpha polysticha* Boheman, is the more common of the oblong-oval, convex, brick red tortoise beetles of this genus which occurs in Puerto Rico. It has an abundance of black spots on the elytra, arranged quite regularly in rows on the disc, but tending to break up into groups of black punctures along the lateral margins. It is apparently not so common as formerly, for Mr. August Busck collected numerous specimens at Fajardo in February 1899. Two specimens were recently noted resting on sugar-cane: at Juncos and at Loíza; Dr. Richard T. Cotton found it on egg-plant at Juncos; Mr. Thos. H. Jones one on wild morning glory at Río Piedras; Prof. J. A. Ramos one at Mayagüez; and Dr. Stuart T. Danforth had one from Barros and found another eaten by the oriole at Cartagena Lagoon.

What is now listed as subspecies **geniculata** Boheman of **Chelymorpha cassidea** Fabricius was considered a valid species by Weise. Listed by Dr. Gundlach, it is not at all common, altho Dr. Richard T. Cotton (1918–308) mentioned it as a pest of sweet potatoes. It has fewer spots on the elytra and more on the pronotum.

Deloyala guttata Olivier, listed by Weise and Drs. Stahl and Gundlach as a *Coptocycla*, is a tortoise beetle which when alive is bright golden in color, broadly oval, subdepressed, with the margins of its thorax and elytra broadly expanded, very thin and transparent, the humeral angles black. It is often found on wild morning glory, and more rarely on sweet potato vines. Dr. Alex. Wetmore noted it as eaten by the ani, kingbird, cliff swallow, mockingbird, yellow-shouldered blackbird, oriole and grasshopper sparrow, and Dr. Stuart T. Danforth found it eaten by the semipalmated sandpiper at Cartagena Lagoon. As *Coptocycla signifera* Herbst it was listed by Mr. Thos. H. Jones (1916–6) as a pest of sweet potato, and by Dr. R. T. Cotton (1918–307), the latter noting that "the peculiar-shaped, yellowish larvae also feed on the leaves, but do not cause nearly as much damage as do the adults". This tortoise beetle occurs in all the Greater Antilles, the United States, Central America and Brasil, and in Puerto Rico has been collected at Ponce, Yauco and Boquerón, as well as in the more humid regions of both coast and mountains. In October and November of 1939, these beetles were noted in great abundance on sugar-cane at Guánica, the adults having been forced to migrate from small vines of

morning glory when these were weeded from the cane fields and their margins.

Four species of **Metriona** are listed from Puerto Rico, the type of that which C. H. Boheman in his "Monographia Cassididarum" (**3:** 333. 1865) describes as *Coptocycla* **glaucina** being from the Island, altho this is not listed by Weise, who gives only *Coptocycla* **bisbinotata** Boheman.

Metriona quadrisignata Boheman, as identified by Mr. H. S. Barber, of specimens collected at Ponce, is also represented in the Stuart T. Danforth collection by specimens from Aibonito. Prof. A. J. Ramos made collections in the Maricao and Guánica Forests; those from the mountains, when alive, being singularly beautiful, looking like pieces of gold against the dark green vegetation.

The Cuban and Hispaniolan species **Metriona subsignata** Boheman is listed from Puerto Rico, but is represented by no recent collection. Indeed, the only tortoise beetles recently noted to which this name may refer were found in great abundance on wild morning glory and on sweet potato foliage by Prof. J. A. Ramos at Mayagüez in July 1943. They had two golden stripes on the black background of each elytron, and seem identical with others from Haina, Dominican Republic, which Dr. E. A. Schwarz had identified as *Metriona propinqua* Boheman.

Bruchidae (Mylabridae): Bean and Pea Weevils

The bean and pea weevils do not have the pronounced beak of the true weevils, but are short little thick-bodied beetles with the tip of the abdomen not covered by their short elytra. The females of many species lay individual eggs in the immature bean or pea, the larva develops inside, often emerging as an adult in a country far distant from that in which it originated. Others are able to oviposit in dried legumes in storage, and several generations may develop before the infested beans are discarded as valueless for human consumption. Thus the records of occurrence of several of the economic species in Puerto Rico may refer to finding them in dried beans or peas actually present in Puerto Rico at the time of the collection of the specimens, but which had been grown and become infested in the United States, Spain or Venezuela. After the infestation of the dried legumes becomes apparent in Puerto Rico is too late to prevent or avoid injury.

Bruchus pisorum Linnaeus, the cosmopolitan pea weevil, may, or may not attack peas here, but adults have been repeatedly been collected here, their host being dried peas from other countries. Usually but a single grub develops in one pea, and the species can not reproduce in dry peas.

The single record of the broad bean weevil, **Bruchus rufinanus** Boheman,

as determined Mr. E. G. Smyth, is of being reared in Puerto Rico from broad beans from Spain.

Acanthoscelides amicus Horn, found in Texas, Arizona and lower California infesting the seeds of the screw bean or tornillo, is reported from Puerto Rico.

Acanthoscelides centrimaculatus Allard, is recorded by Dr. Gundlach from Puerto Rico under the name *Bruchus cinerifer* Chevrolat, with the note: "Tambien se encuentra en la flor del Júcaro (*Terminalia*) en la Cienaga de Zapata en Cuba". No specimen has since been collected here which can be referred to this, the only Bruchid mentioned by Dr. Gundlach.

The record of **Acanthoscelides livens** Suffrian is based on a doubtful determination by Dr. E. A. Schwarz of a single reddish-brown Bruchid collected from the arrows of sugar-cane at Río Piedras.

Acanthoscelides dominicanus Jekel, originally determined as a *Bruchus* by Mr. G. E. Bryant, and subsequently re-determined by Messrs. H. S. Barber and A. J. Mutchler, has repeatedly been reared from the pods of "aroma" (*Acacia* or *Vachellia farnesiana*) and of mesquite or "bayahonda" (*Prosopis* or *Neltuma juliflora*), at Guánica and Boquerón, in the southwestern corner of the Island. From "yerba de San Martín" (*Sauvagesia erecta*) growing in the Guánica Forest, Prof. J. A. Ramos has reared these weevils. The adult is an elongate, light brown beetle, with a group of irregular darker spots on the disc of the elytra so short as to leave exposed almost a third of the abdomen.

Acanthoscelides obtectus Say, the cosmopolitan bean weevil, has been repeatedly reared from dry beans imported from the United States and from Venezuela. Possibly it is a permanent resident, for we have one record of its occurrence in white beans grown locally, but none in red beans. After the primary infestation in the field, succeeding generations of females are able to oviposit in dry beans held in storage, so that eventually all beans are completely destroyed.

Acanthoscelides ochraceicolor Pic, as determined by Mr. H. S. Barber, was found by Mr. R. G. Oakley in the flowers of "guácima" (*Guazuma ulmifolia*) at Ponce.

Mr. J. C. Bridwell identified as "close to *prosopis* LeConte" the *Acanthoscelides* weevils which Mr. D. L. Van Dine reared from pods of "algarrobo" (*Hymenaea courbaril*) at Río Piedras in April 1911. Similarly somewhat doubtful is the identification by Mr. H. S. Barber of *Acanthoscelides podagricus* F. for the weevils which Prof. A. J. Ramos reared from pods of *Ichthyomethia piscipula* at Faro de Cabo Rojo.

Acanthoscelides *SALLAEI* Sharp was identified by Mr. H. S. Barber for weevils collected by Mr. R. G. Oakley at Ponce, but others from southwestern Puerto Rico he thought to be only "near" this species.

Acanthoscelides xanthopus Suffrian, a Cuban Bruchid, was identified by Mr. H. S. Barber from Puerto Rican material: collections at Mayagüez by Prof. J. A. Ramos and at Guánica by Mr. R. G. Oakley. Other Bruchids collected at Ponce on flowers of *Randia mitis*, and of *Peiranisia polyphylla*, are "near" this species.

Callosobruchus chinensis Linnaeus, a cosmopolitan cowpea weevil, has often been reared in Puerto Rico from cowpeas originating elsewhere, but it may indeed be established here, as it has once been reared from dry pigeon peas at Río Piedras by Mr. A. S. Mills.

The southern cowpea weevil, **Callosobruchus maculatus** Fabricius, as determined by Mr. H. S. Barber, has been collected on moca at Ponce, on avocado at Utuado and at San Juan. The variety **barbicornis** Fabricius is listed by Leng & Mutchler. This cosmopolitan species, commonly referred to under the synonym of *Mylabris quadrimaculatus* Fabricius, the four-spotted bean weevil, has several times been found destroying cowpeas imported from the States, and once has been collected from infested dry peas from Georgia.

Mr. J. C. Bridwell names "A New **Amblycerus** affecting Seeds of *Prosopis chilensis* in Puerto Rico and Hispaniola" (Jour. Agr. Univ. P. R., **27** (3): 133–5. Río Piedras, September 11, 1944) **martorelli,** after Dr. Luis F. Martorell, who reared the type material from seed-pods of *Neltuma juliflora* at Guánica. This is a reddish-brown beetle, from 5 to 6.5 mm. long, "uniformly yellowish cinereous above and pale beneath", which is also found in Hispaniola, where it was reared from the same host, mesquite or "bayahonda".

Zabrotes subfasciatus Boheman (=*Spermophagus pectoralis* Sharp), the Mexican bean weevil, another cosmopolitan Bruchid, has been reared from beans and peas from the States and from Venezuela. Because of its temporary abundance from outside sources, it may come to light in large numbers, or be found in the stomachs of birds, as it is reported by Dr. Alex. Wetmore as eaten by the flycatcher, wood pewee and parula warbler.

Caryobruchus giganteus Chevrolat, as a *Pachymerus*, is listed from Puerto Rico by Leng & Mutchler.

Anthribidae: Fungus Weevils

Homocloeus conspersus, described by Herr P. Wolfrum in his short paper "Ueber Anthribiden von Cuba" (D. E. Z., 1930, pp. 25–32) from Puerto Rican material, is presumably the same species as that repeatedly intercepted by Mr. R. G. Oakley: on moca at Ponce, on coffee at Adjuntas and on guava at Aibonito. Unfortunately, none of the specimens in this family collected by Mr. Oakley in Puerto Rico, and identified only to genus by Mr. L. L. Buchanan, was available to Herr Wolfrum for description.

On dead wood at Indiera, in the mountains north of Yauco, Mr. Oakley found a new species of **Gymnognathus,** and a new species of **Neanthribus** on pomarrosa in the mountains north of Ponce.

Ormiscus micula Jordan, described from Grenada, and present also in St. Vincent, is the only named species of this genus present in the West Indies. Numerous specimens of **Ormiscus** have been collected in Puerto Rico, however, Dr. Stuart T. Danforth having them from Tortuguero Lagoon and from Coamo. At least two distinct species were intercepted by Mr. Oakley in the Ponce region: found resting on trees or rotten wood, or on the flowers of *Inga laurina* in the mountains above Yauco.

Brachytarsus sp. was the determination given by Dr. E. A. Schwarz to some small spotted Anthribid beetles found at Boquerón in 1923 in pods of "aroma" (*Acacia farnesiana*), but not since noted.

Euxenus anthoceroides Wolfrum (1930–31) is known only from the type from Puerto Rico.

Brentidae: Primitive Weevils

Paratrachelizus linearis Suffrian, described originally from Cuba, was found both there and in Puerto Rico by Dr. Gundlach "debajo cortezas". It is typical in appearance of these extremely elongate Brentid or Brenthid weevils, but has a short head behind the eyes, and an entirely smooth but dull, dark reddish-brown body, without markings.

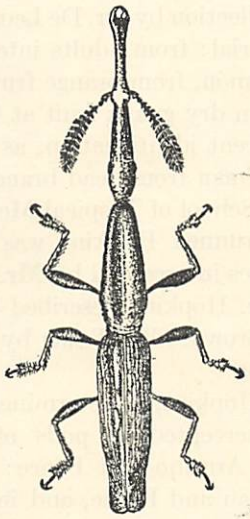
Stereodermus exilis Suffrian, described originally from Cuba, is the only species of this genus recorded from any of the West Indies. **Stereodermus** species is the determination by Mr. L. L. Buchanan of the specimen intercepted by Mr. Stuart D. Whitlock at Mayagüez on decaying wood.

Belopherus maculatus Olivier is found in the larger of the Greater Antilles, being listed by Dr. Gundlach from Puerto Rico as *Belophorus militaris* Olivier "debajo de la corteza muerta". It is usually not more than an inch long, mostly shining dark brown in color, with lighter yellowish eyes and elongate spots on its deeply striate elytra, the outer posterior angles of which are produced in sharply pointed horns. All records are of occurrence in the mountains, under the dead bark of trees, or resting on the trunks of trees or mountain palms.

Brentus volvulus Fabricius varies greatly in size, some individuals being scarcely an inch long, while others are twice as long. Its deeply striate elytra are marked with four elongate yellowish spots, often tending to become confluent, but normally sharply separated. It occurs along the coast of Puerto Rico, as well as in the lower mountains, not only under dead bark of trees and on their trunks, but also on corn and cotton, a pair having been found on grapefruit blossoms at Mayagüez. At the highest

elevations, these elongate beetles have been found on coffee leaves and in virgin forest.

Brentus vulneratus Gyllenhal, listed in 1780 by the Botanist Ledru from Puerto Rico as *Brentus nasutus* F., and subsequently by Drs. Stahl and Gundlach as *Brentus turbatus* Boheman, occurs also in Mexico and Central America, as well as in others of the Greater Antilles. No recent collection from Puerto Rico is recorded, but possibly those individuals with concavely outwardly distended posterior margins of the elytra may be assigned to this species, those with normally curved and neatly tucked-in elytra being *Brentus volvulus*. Most of these large beetles are heavily



Brentus volvulus F., twice natural size. (Drawn by F. Maximilien.)

infested with the nymphs of Uropodid mites: a strange choice it would seem, if the mites are expecting rapid transportation, for their hosts are decidedly slow-moving, at least in the daytime. Nothing is known of the immature stages of these beetles, and we can merely presume that the larvae are borers in rotten wood.

Scolytidae: Bark & Timber Beetles

Hypothenemus eruditis Westwood, as identified by Dr. M. W. Blackman, was collected by Dr. Donald De Leon at Camp Doña Juana, Villalba, in a small dead pole of "maricao" (*Byrsonima spicata*), and in dead twigs of "masa" (*Tetragastris balsamifera*) at Ciales.

Hypothenemus of a species near **parvus** Hopkins, as determined by Dr.

M. W. Blackman, has entirely different habits, adults having been intercepted in orange fruits at Ponce and Mayagüez, in fruit of "maga" (*Montezuma speciosissima*) at Vega Alta, in dry tobacco at Loíza and in dry pigeon peas at San Juan. Dr. Hopkins described *parvus* from females 1.0 mm. in length collected by Dr. E. A. Schwarz at Cayamas, Cuba "from old cotton bolls."

Stephanoderes brasiliensis Hopkins, as determined by Dr. M. W. Blackman, was reared by Dr. Donald De Leon from larvae in the stems of *Derris eliptica* being grown at Río Piedras: a possible clue as to how an insect described from Pernambuco, Brazil should be found in Puerto Rico. In fact, however, this species had been definitely identified by Dr. Blackman several years before its collection by Dr. De Leon, but after the introduction in 1930 of the host material: from adults intercepted in decayed flowerstalks of banana at Bayamón, from orange fruit at Ponce, from almendra fruit at San Germán, from dry guava fruit at Corozal, from grapefruit at Bayamón. The most recent identification, as "near," is of material collected by Dr. W. A. Hoffman from dead branches of flamboyán (*Delonix regia*) in the patio of the School of Tropical Medicine.

Stephanoderes near **brunnea** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted by Mr. R. G. Oakley in mangrove seed balls at Ponce. Dr. Hopkins described *brunnea* from females 1.35 mm. long, collected at Brownsville, Texas by Mr. H. S. Barber, "body stout, dark brown, shining."

Stephanoderes buscki Hopkins, as determined by Dr. M. W. Blackman, has been repeatedly intercepted in pods of "algarrobo" (*Hymenaea courbaril*), at San Juan, Arecibo and Ponce; in tamarind (*Tamarindus indica*) pods from San Juan and Ponce, and in mummied guava fruit at Peñuelas. The type of *buscki* was collected by Mr. August Busck in Trinidad, B. W. I.

Stephanoderes georgiae Hopkins was found in the same mummied guava fruit from Peñuelas, associated with *S. buscki*. The type of *georgiae* is from the State of Georgia, U. S. A.

Stephanoderes near **ferruginea** Hopkins was the determination by Dr. M. W. Blackman of beetles found by Dr. Luis F. Martorell infesting the dried seed pods of "emajaguilla" (*Thespesia populnea*) along the road from Guayanilla to Ponce.

Stephanoderes "near, but not *hampei* Ferrari" was the determination by Dr. M. W. Blackman of beetles reared from mummied or cull *excelsa* coffee berries from Lares in 1941. Mr. Francisco Seín found no larvae in green berries of *excelsa*, or in those of which pulp surrounded the beans, but only in the mummied fruit, and none in any kind of berries of *arabica* coffee, even those which were mummied on trees in the same grove as the *excelsa*

trees. Search for other *excelsa* trees in Puerto Rico indicated that the mummied fruits from these scattered trees were also infested, and that the beetle had not previously been noted because the few trees at Lares were the first to yield enough berries to be commercially processed.

Stephanoderes near **guatemalensis** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted at Arecibo in decaying papaya fruit. The type of *guatemalensis* was from cacao fruit.

Stephanoderes opacifrons was described by Dr. A. D. Hopkins in his "Classification of the Cryphalinae, with Descriptions of new Genera and Species" (Report No. 99, Office of the Secretary, U.S.D.A., pp. 1–75, pl. 4. Washington, D. C., 1915) from females 1.1 mm. long, dark brown, opaque, collected by Mr. August Busck in January 1899 at Aguadilla, Puerto Rico. No specimen identified as this species has since been found in Puerto Rico.

Stephanoderes near **texanus** Hopkins was the identification by Dr. M. W. Blackman of beetles intercepted on citron at Palo Seco.

Stephanoderes trinitatis Hopkins, as identified by Dr. M. W. Blackman, was collected by Dr. Donald De Leon from a dead twig of "guaraguao" (*Guarea trichilioides*) at Patillas, associated with another species of *Stephanoderes* which could not be identified. The type of *trinitatis* was collected by Mr. August Busck at Monteserrat, Trinidad, B. W. I., with no host indicated.

Additional species of **Stephanoderes** doubtless occur in Puerto Rico, for Dr. Hopkins did not assign a name to those collected from dying twigs of Australian silver oak (*Grevillea robusta*), nor have many intercepted since been identified. The lizards *Anolis pulchellus*, *Anolis stratulus* and *Anolis cristatellus* eat these beetles in considerable numbers, but seldom many at any one time. They also eat considerable numbers of similar small beetles of the genus *Xyleborus*, which are often twice as large or larger than *Stephanoderes*. The *Xyleborus* beetles are a considerable item in the food of the cliff swallow, as noted by both Dr. Alex. Wetmore and by Dr. Stuart T. Danforth. The barn swallow and the spotted sandpiper were found by Dr. Danforth to eat *Xyleborus* beetles, and Dr. Wetmore found them in the stomach contents of the parula and yellow warblers, and of the honey creeper.

Xyleborus affinis Eichoff is possibly the most abundant species of the shot-hole borer beetles, and has an extremely wide distribution, being found from as far north as New Jersey in the United States "in oak stumps," in most of the countries of Central America, in many of the West Indies and especially in all of the Lesser Antilles where sugarcane is grown, to tropical South America, including Argentina. Dr. Hopkins notes in his description (1915–64) of *Xyleborus sacchari* from St. Vincent that "this is at once distinguished from specimens identified by Eichloff as *X. affinis*,

and received from his type series, in the smaller size and more shining front and also in the distribution," but Dr. M. W. Blackman in April 1935 wrote: "I regard *Xyleborus sacchari* Hopkins as no more than a variety of *X. affinis* at best, and in a long series of so-called *sacchari*, typical *affinis* appear usually to be present." Formerly it was of very considerable economic importance because of heavy infestations of sugar-cane, more especially of the old Otaheite or white cane, which was one of the original varieties on which the industry was based. Otaheite cane grows well on virgin soil, but is poorly adapted to old, worn-out soils, and was entirely displaced where more vigorous varieties were developed. At the present time it is doubtful is any of this variety can be found anywhere in the world. The newer varieties of sugar-cane are practically or entirely immune to attack by these shot-hole borer beetles, which in recent years have not been noted on sugar-cane anywhere in Puerto Rico. Nevertheless, *Xyleborus affinis* is still a serious pest, attacking coconut palm tree trunks, and what appear to be perfectly healthy trees of *Albizia lebbeck*, sometimes perfectly healthy trees of *Inga vera* and *Inga laurina*, and is almost invariably present in the trunks of these coffee shade trees which show any indication of disease or injury from some other cause. It is very difficult to prove that in every case of infestation the tree was previously injured or diseased, but it is quite possible that these beetles may attack those which were perfectly sound, as were the stalks of Otaheite cane when they were attacked. Fortunately, most coconut palms and most coffee shade trees escape attack, but *Albizia lebbeck* at present seems particularly susceptible, just as was Otaheite cane years ago. Blatchley & Leng (1916–619) quote from Hubbard that "a solitary female starts the galleries, in each of which five or six eggs are deposited. The young, hatching, feed upon the ambrosia which glistens on the walls like hoar frost. The pupae are formed lying free in the galleries, and in somewhat over a month from the egg the perfect beetles appear. In time, besides the mother, 15 or 20 offspring females have become adult, but only one or two males are commonly found. A second generation may be started, but usually the seasoning of the wood threatens failure of food fungus and the younger females depart to found new colonies in fresh tree tunks. Many kinds of trees are attacked: maple, orange, pine, oak and ash being especially mentioned by Hubbard," for Florida. In addition to sugar-cane, coconut palms, coffee shade trees and *Albizia lebbeck*, in Puerto Rico, interceptions of these beetles have been made from guava fruits at Cabo Rojo and orange fruit at Ponce by Mr. R. G. Oakley, from dry crotalaria pods, and at light at Mayagüez and Bayamón.

Xyleborus torquatus Eichhoff, another widely distributed neotropical shot-hole borer beetle, previously recorded from Puerto Rico, was identified

by Dr. W. H. Anderson as being probably the species principally responsible, with *X. affinis*, for killing the trees of *Albizia lebbeck* in the Río Piedras region in 1944–45.

Xyleborus amplicollis Eichhoff, the type from Puerto Rico, originally described in the Berliner Entomologische Zeitschrift (1868–280), has not since been found, either here or elsewhere.

Dr. M. W. Blackman identified the beetles intercepted by Mr. R. G. Oakley in orange fruit at Ponce as being a species of *Xyleborus* near *bispinatus* Eichhoff, this being a species known only from Brasil.

Xyleborus confusus Eichhoff occurs from Mexico southward thru Central America and all of tropical South American into Argentina, as well as in the West Indies, with records from most of the Lesser Antilles. As determined by Dr. W. H. Anderson, it was collected at light on Mona Island by Prof. J. A. Ramos (1947–44), the only record of a shot-hole borer from Mona. In Puerto Rico, beetles were collected from dying coconut palm trees at Cabo Rojo, as identified by Dr. A. D. Hopkins, and subsequent collections have been made from dead or dying palm trees at Camuy, San Lorenzo and Loíza, in no instance being associated with *Xyleborus affinis*. All stages, as identified by Dr. Hopkins, were present in great abundance under the bark and in burrows just underneath the bark of dead "bucare" (*Erythrina poeppigiana*) trees at Cayey. Dr. Donald De Leon collected an adult on the bark of a "moca" (*Andira jamaicensis*) tree at Ponce, and others have been intercepted in orange fruit at Aguadilla and at light at San Juan.

Xyleborus ferrugineus Fabricius "viene por la noche a las luces de las casas" in Puerto Rico according to Dr. Gundlach.

Xyleborus fuscatus Eichhoff, as determined by Dr. M. W. Blackman, was collected by Dr. Donald De Leon boring in the trunk of dead "almácigo" (*Bursera simaruba*) trees near Guayama.

Xyleborus grenadensis Hopkins, "at once distinguished from *affinis* by the shining declivity (but) nearly allied to *X. torquatus*," was found associated with *fuscatus* by Dr. De Leon in the dead trunk of "almácigo," and collected by him in abundance at light in the Guánica Forest, as well as high in the mountains at Maricao under the dead bark of "granadillo" (*Buchenavia capitata*).

Xyleborus inermis Eichhoff, listed by Mr. R. H. Van Zwaluwenburg (P.R. 810), and by Dr. Alex. Wetmore as eaten by the cliff swallow and the honey creeper, has subsequently been identified by Dr. M. W. Blackman from adults intercepted in mango at San Juan.

Coccotrypes bassiaevora Hopkins was identified by Dr. M. W. Blackman from beetles intercepted by Mr. R. G. Oakley in orange fruit at Ponce.

Coccotrypes rolliniae Hopkins was identified by Dr. M. W. Blackman

from beetles reared from the seeds of the palm *Neowashingtonia robusta* at Río Piedras by Mr. Francisco Seín. The type was from the seeds of *Rollinia octopetala* at Belém do Pará, Brasil.

Chalcohylus securigerus, described by Dr. M. W. Blackman as one of "New Genera and Species of Bark Beetles of the Subfamily Micracinae (Scolytidae, Coleoptera)" (Proc. U. S. National Museum, **29**, (3165): 341–365, pl. 2. Washington, D. C., 1943) on p. 364, is from a type intercepted by Mr. R. G. Oakley on dead wood at Yauco, P. R., and another from Haiti on "bois chandelle" (*Amyris balsamifera*).

Ambrosiodmus lecontei Hopkins was identified by Dr. M. W. Blackman from material collected by Dr. Donald De Leon at El Verde Camp, Río Grande, in dying terminals of "cedro" (*Cedrela mexicana*), and in dead twigs of "aceitillo" (*Zanthoxylum flavum*) at Maricao.

Of the beetles collected by Dr. Donald De Leon which Dr. Blackman did not assign to species are a **Pterocyclon** on "tabonuco" (*Dacryodes excelsa*), associated with a new species of **Ambrosiodmus**, at El Guineo Camp at Villalba.

Anisandrus sp. was the determination by Dr. M. W. Blackman of a beetle intercepted by Mr. R. G. Oakley in dead wood at Guayanilla.

Pycnarthrum sp. nov. was the determination by Dr. M. W. Blackman of beetles found by Dr. Luis F. Martorell breeding and boring in the bark of a recently cut tree of *Artocarpus communis* in Guajataca Gorge at Quebradillas.

Dendrosinus bourreriae, described by Dr. E. A. Schwarz as "A New Scolytid from Florida" (Proc. Ent. Soc. Washington, **22**: 220–26. Washington, D. C., 1920), was intercepted in orange fruit at Ponce by Mr. R. G. Oakley, as identified by Dr. M. W. Blackman.

Hexacolus sp. nov. was the determination by Dr. M. W. Blackman of beetles intercepted in a dead tree at Matrullas Dam by Mr. R. G. Oakley.

Platypodidae: Wide-headed Ambrosia beetles

Platypus compositus Say, a continental species of the southern United States, Mexico and Brasil, has been identified by Dr. M. W. Blackman from material collected by Dr. Donald De Leon from a log of "tabonuco" (*Dacryodes excelsa*) at El Guineo Camp, Villalba.

Platypus excisus Chapuis is a Central American species which Dr. M. W. Blackman identified from an abundance of beetles coming from blackened tunnels in logs of the coffee shade tree, *Inga vera*, at Aibonito.

Platypus poeyi Guérin-Méneville "talandra la madera en dirección de la corteza al corazón" according to Dr. Gundlach.

Beetles intercepted at light by Mr. S. D. Whitlock at Mayagüez were

identified by Dr. M. W. Blackman as a species of **Platypus** near **porrectus** Chapuis.

Platypus punctulatus Chapuis is recorded from Puerto Rico (Blackwelder 1947–790).

Platypus ratzeburgi Chapuis, as identified by Dr. A. D. Hopkins, has been found in great abundance coming from logs of the coffee shade trees, *Inga vera* and *Inga laurina*, from Lares and Ciales, and is presumably present thruout the coffee regions.

Platypus rugulosus Chapuis, a widely distributed continental species, from lower California to Argentina, was first identified from Puerto Rican material by Dr. A. D. Hopkins who examined beetles collected by Mr. Thos. H. Jones at light at Mameyes. It has since been intercepted at light at Mayagüez, in a grapefruit grove at Barceloneta and on flowers of *Inga vera* at Aibonito. Dr. Donald De Leon found it abundant at light at Guánica Forest, in broken limbs of "moca" (*Andira jamaicensis*) at Ponce, and in the mountains at El Guineo Camp, Villalba in logs of "tabonuco" (*Dacryodes excelsa*). It has been reared in large numbers from logs of "almácigo" (*Bursera simaruba*) at Camuy, and, judging by the number of records, is the most abundant of the Platypodid beetles in Puerto Rico.

Platypus schaumi, described from Puerto Rican material by Félicien Chapuis in his "Monograph des Platypides" (Memoirs de la Soc. Royale des Sci. Liege, **20:** 181, 1885 or 1886), has not since been found here.

Platypus subcostatus Jacq. DuVal, described from Cuba, is listed by Dr. Gundlach from Puerto Rico, but has not recently been found here.

Dr. Alex. Wetmore found that 41% of the stomach contents of the cliff swallow consisted of beetles of the genus *Platypus*. As many as 400 of these beetles were eaten at a single meal, and several birds had taken 200 or over. Near Aguadilla, in June, the swallows were capturing large numbers for their young, carrying them in the back of the mouth and below the tongue in a well-moistened mass." They form an important fraction of the food of the wood pewee and the green mango, and are also eaten by the black swift, the tody, the woodpecker, the honey creeper, and by the parula and black and white warblers. Lizards in coffee groves also eat these beetles emerging from coffee shade trees, dead, dying or cut for charcoal, and in the stomachs of *Anolis evermanni*, *Anolis stratulus* and *Anolis gundlachi*, the beetles have been found in considerable abundance. Whole beetles have been found embedded in amber in Hispaniola.

Curculionidae: Weevils

Artipus monae Wolcott, described ("IBSup" 1941–102) from weevils collected by Dr. Luis F. Martorell on beefwood (*Casuarina equisetifolia*) foliage on Mona Island, is "elongate oblong, piceous, everywhere densely

clothed with dull silvery scales, often tarnished to a faded brown in larger individuals." Prof. J. A. Ramos (1947–43) swept them in abundance from Sardinera and Uvero Beaches, and Dr. Martorell noted adults feeding on the foliage of *Amyris elemifera* in April 1944. It is quite possible that the same species is also present in Puerto Rico, specimens intercepted on leaves of castor bean at Ponce and on "mabí" at Mayagüez having been identified as a species of *Artipus* by Mr. L. L. Buchanan.

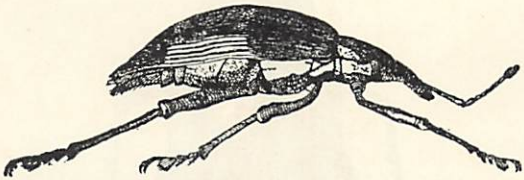
Lachnopus coffeae, long before it was named and described by Sir Guy A. K. Marshall among "Some Injurious Neotropical Weevils (Curculionidae)" (Bull. Ent. Research, **13** (1): 59–78, pl. 2, fig. 4. London, May 1922), was well known to coffee growers, and its injuries to the tender growth of coffee described by Don Guillermo Quintanilla as the "Enfermedad de los Cafetales en Adjuntas: La Plaga de la Vaquita" (La Reforma

Lachnopus coffeae Marshall, six times natural size. (Drawn by G. N. Wolcott.)

Agricola, año 3, No. 12, pp. 217–224. San Juan, November 1896), and by Mr. J. W. Van Leenhoff in the "Report of the Coffee Specialist" (*in* Ann. Rpt. P. R. Agr. Expt. Station for 1905, pp. 46–47. Washington, D. C., 1906). Mr. R. H. Van Zwaluwenburg, in discussing the "Insects Affecting Coffee in Porto Rico" (Jour. Ec. Ent., **10** (6): 513–17. Concord, December 1917), gives the most extended account up to that time, even noting the parasitism of its eggs by a Chalcid wasp, which was later very imperfectly described as *Tetrastichus vaquitarum* Wolcott. These shining, black and white beetles have the "integument piceous, with the legs, antennae and apex of rostrum reddish brown, clothed above and below with small, convex, shiny, subcircular or very shortly ovate, white scales, mostly not contiguous; the elytra usually with three very irregular transverse subdenuded patches. Length 5.5–6.25 mm., breadth 1.8–2. mm.," to quote from Sir Guy's original description. They occur thruout the lower

coffee regions, primarily feeding on the tender leaves of coffee, but have also been found eating tender orange and grapefruit leaves along the north coast, while Mr. R. G. Oakley intercepted them on chinaberry at Ponce. Even in captivity they may live nearly two months, the females laying small clusters of oval eggs glued between two leaves, from which maggots hatch in from ten to fourteen days. Falling to the ground, the grubs enter thru cracks and feed on the roots of plants. The appearance of the adults usually coincides with a flush of new growth on the coffee trees, so that despite the damage caused by them, it is quickly repaired and replaced with additional foliage. The application of arsenicals to these shiny tender leaves is hardly practical, and no attempt at control, even by hand picking, is normally attempted by coffee growers.

Lachnopus coffeae, var **montanus** Marshall (1922–62), the type from Indiera, equidistant from Lares, Maricao and Yauco, "differs from the typical coast form in being somewhat larger and having the legs markedly

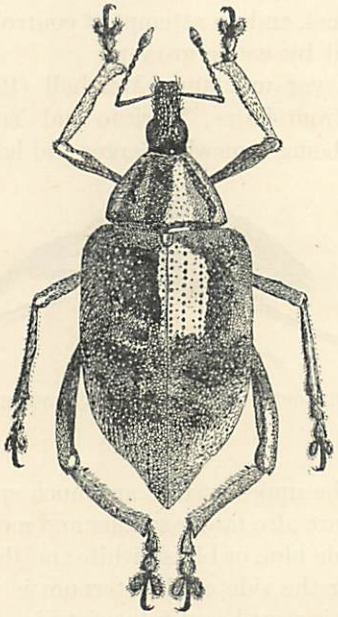


Lachnopus coffeae var. *montanus* Marshall, six times natural size. (Drawn by G. N. Wolcott.)

paler; the scales on the upper surface are much sparser and more evenly distributed, and they are also rather smaller and more nearly circular; most of them being very pale blue or bluish white; on the other hand the stripe of white scaling along the side of the sternum is much denser and more sharply defined." This most beautiful variety is economically comparable to the coastal form, occurring in the coffee groves at the higher elevations, and having also been noted feeding on the tender leaves of *Cestrum macrophyllum* at Cialitos, and of *Isandrina emarginata* in the pass between Cayey and Salinas.

Lachnopus curvipes Fabricius is a considerably larger beetle than the endemic *coffeae*, and occurs also in Jamaica, Tortola of the Virgin Islands, and St. Barthélemy and St. Vincent of the Lesser Antilles. L. A. Auguste Chevrolat (1876–227) records the first collections by Dr. Stahl and Gundlach. One may presume that many of the records of this species being eaten by birds of the coffee groves and of the virgin forests, as recorded by Dr. Alex. Wetmore, include those of the at-that-time-undescribed *coffeae*. The birds noted are the cuckoo, ani, owl, kingbird, petchary, flycatcher,

mockingbird, vireo, parula warbler, honey creeper, yellow-shouldered black bird, oriole, mozambique, tanager, spindalis, grossbeak and grasshopper sparrow. The lizards *Anolis pulchellus* and *Anolis cristatellus* also feed on these weevils, as does also the introduced toad, *Bufo marinus*, but hardly in sufficient numbers to appreciably effect their abundance. The adults occur at all seasons of the year and in every part of the Island, with the possible exception of the higher mountains, feeding on a great variety of host plants, including such economic plants as cotton, orange, grapefruit, cabbage, swiss chard, watermelon, lima bean, and numerous weeds, bushes



Lachnopus curvipes F., six times natural size. (Drawn by G. N. Wolcott.)

and trees. The damage to most economic plants is negligible, but the attack of these beetles on the flowers and tender fruit of cultivated grape at Ponce in April 1939 was serious, and necessitated the immediate adoption of hand collection if any fruit was to be obtained.

Lachnopus kofresi Wolcott, described ("IPSup" 1941–104) from an abundance of material collected by Dr. Luis F. Martorell from the underside of the leaves of cultivated eggplant being grown at that time on Mona Island, has its integument entirely black, and has no scales, only short, silvery hairs on tibiae and tarsi. It is quite common on Mona Island, and adults have been found resting on the stems or leaves of numerous plants and shrubs.

Lachnopus seini Wolcott ("IB" 1936–302) is similar in size and appearance to *coffeae*, but is "entirely and evenly clothed with very small, convex, shiny, subcircular scales, with no constant areas of denudation," having been found feeding on the tender leaves of *Rapanea ferruginea* at Indiera, the type material collected by Mr. Francisco Seín, and subsequent collections on the same host made at Aibonito.

Lachnopus trilineatus Chevrolat (1876–228) was described from type material collected in Puerto Rico by Dr. Gundlach, of which no subsequent collection has been made.

Lachnopus valgus Fabricius is listed by Dr. Gundlach from Puerto Rico, but has not since been found here. The type is from St. Barthélemy in the Leeward Islands, and it is also recorded from Anguilla.

Lachnopus yaucona Wolcott ("IB" 1936–302) is somewhat larger than *coffeae*, its integument light brown, its scales light yellow in color, the type. material having been collected on *Rapanea ferruginea* at Indiera by Mr Francisco Seín in August 1933. No subsequent collection has been made.

Apodrosus argentatus Wolcott ("IP" 1924–130) has piceous to black integument, "evenly and closely covered with small, subcircular, silvery scales, interspersed, scantily on head, more thickly on prothorax, with black scales; length 4.0–4.5 mm., breadth 1.8–2.0 mm.," the type from *Dalbergia ecastophyllum* at Pt. Cangrejos, others on this host at Pt. Salinas, Mameyes and Boquerón. Its habitat is the beaches of Puerto Rico and Mona Island, adults having been found in abundance on "abeyuelo" (*Colubrina ferruginosa*) at Guánica and on Mona; intercepted on "mabí" (*Colubrina reclinata*) at Mayagüez, on tamarind and *Peiranisia* at Ponce by Mr. R. G. Oakley, noted feeding on the leaves of "mangle botón" (*Conocarpus erecta*) at Faro de Cabo Rojo, and of "guayacán" (*Guaiacum officinale*) at Guánica and Salinas.

Apodrosus wolcotti Marshall (1922–59), "fairly closely covered above with small, nearly circular, pinkish-bluff scales having a distinct coppery sheen," was found feeding on the leaves of the coffee shade tree (*Inga vera*) at Río Piedras, and since noted on this host at Cayey, and intercepted on the flowers of *Inga laurina* at Adjuntas. It has also been intercepted on vanilla at Adjuntas, but is most often noted resting on coffee leaves: at Añasco, Indiera, Maricao, Jájome Alto and Manatí.

Compsus maricao Wolcott ("IP" 1924–125), has "integument shining black, densely clothed, except for denuded areas and ridges, with light blue-green scales; length 13.0 mm., breadth 4.5 mm.," the type a single female from Maricao which had just laid eggs between coffee leaves. Mr. R. H. Van Zwaluwenburg had previously collected a specimen in the mountains above Mayagüez which he had presented to the U. S. National

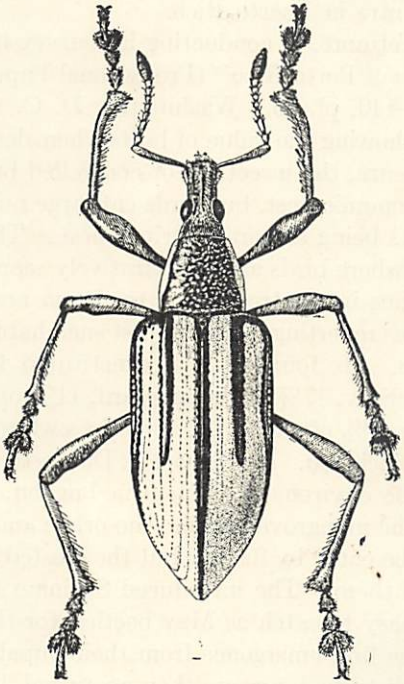
Museum. Recently others have been found: resting on *Eugenia* at Jayuya, and feeding on the leaves of *Cecropia peltata* at Villalba.

Compsus luquillo sp. nov., differs from *maricao* in the color of scales, which are bright yellow in living material, becoming somewhat greenish in museum specimens, and most noticeably in that the median denuded ridge on each elytron extends less than half-way to the base. Near the apex it is joined by a curving lateral ridge extending to the base, where it is joined by a short submarginal ridge. *Compsus maricao* has three parallel ridges extending from the base of the elytron to apex, and one short submarginal ridge. Both are similar in general appearance to *Compsus zebra* Marshall (1922–199) from Colombia, but the dorsum of the prothorax of the Puerto Rican species is broadly and deeply concave and undenuded, while the sutural margin of the elytra is elevated and denuded; quitethe reverse of the apparent contour of *zebra*. The largest specimen of *maricao* measures 13.0 mm. in length; the smallest specimens of *luquillo* somewhat exceed this, the type is 18.0 mm. long, collected feeding on the leaves of "camasey" (*Miconia prasina*), at El Verde Camp, Río Grande, August 22, 1947, one of a pair; three others on the same host at the same locality, July 4, 1946. Admittedly, the differences between *Compsus maricao* and *Compsus luquillo* are no greater than between the named extreme forms of *Diaprepes abbreviata* L., but the variations in *Compsus* correspond to the distinct geographical regions after which they are named, and, to date, no intermediate has been found.

Diaprepes abbreviata Linnaeus, after the statement of Sir Guy A. K. Marshall (1915–627) "is not only the older and therefore more correct name, but is also in general use in the West Indies," has been generally accepted as the name to be applied to the common "vaquita" of Puerto Rico: the sugar-cane root-stalk borer weevil. Dr. Stahl calls it *Prepodes doublieri* Guerin; Dr. Gundlach follows Chevrolat (1876–227) in listing *Diaprepes distinguendus* Boheman as not in synonymy with *Diaprepes comma* Boheman; and Dr. W. Dwight Pierce in his beautifully illustrated paper on "Some Sugar Cane Root-Boring Weevils of the West Indies" (Jour. Agr. Research, **4** (3): 255–271, pl. 5. Washington, D. C., June 15, 1915) calls the "weevil root-borer" of sugar-cane in Puerto Rico *Diaprepes sprengleri* Linnaeus, of which he recognizes three varieties: *abbreviatus* Olivier, *comma* Boheman and *sprengleri* Linnaeus, separable on the basis of scale coloration and denuded elytral ridges. Economically at least, the "vaquita" is but a single species: a large, black, leaf-feeding weevil, attractively scaled with white, cream, yellow, pink or chestnut, of which the larvae bore in the root-stalk of sugar-cane or the roots or tubers of many other hosts.

The variation in the scale coloration and the extent of denudation of the

elytral ridges of the adults of *Diaprepes abbreviata* may be only a reflection of the variation in duration of the stages of the immature forms resulting from intense parasitization by *Tetrastichus haitiensis* Gahan of the eggs which are laid normally in late spring. Indeed, so few grubs survive from egg-clusters laid in May and June, when the parasite is most abundant, that it would appear that the weevil primarily owes its survival to the eggs laid by a comparatively few exceptional and abnormal females emerging from the ground at other times of year when the parasite is scarce or absent.



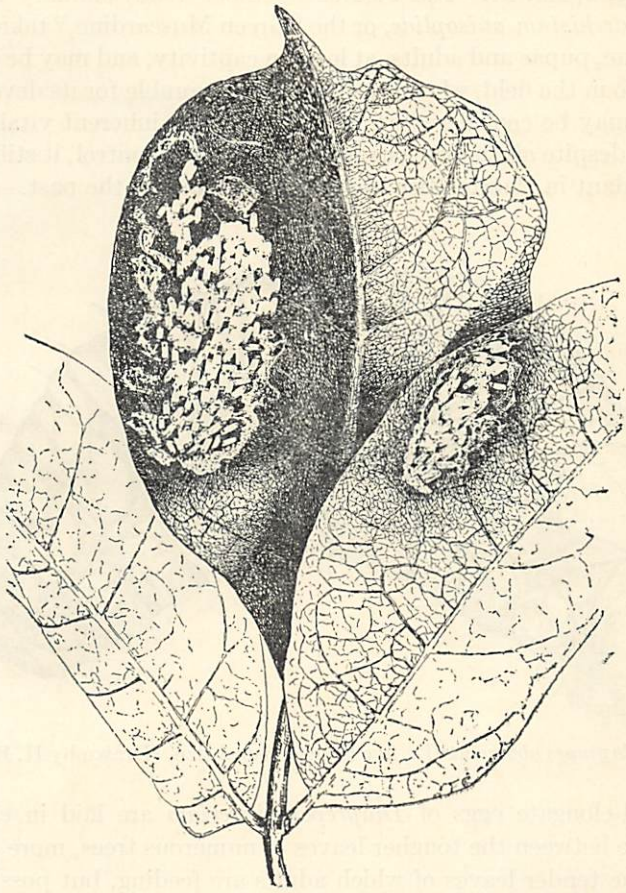
The Sugar-Cane Weevil Root-Stalk Borer, *Diaprepes abbreviata* L., five times natural size. (Drawn by H. Bradford.)

Despite the most intensive investigations on "The Sugar Cane Weevil Root Borer" (Bulletin No. 14, Insular Expt. Station, Río Piedras, pp. 19, fig. 11. San Juan, April 14, 1915) by Mr. Thos. H. Jones, this parasite was not found by him in Puerto Rico at that time, but awaited discovery in Haiti, reared from the egg-clusters of the quite similar *Exophthalmus quadrivittatus* Olivier, in 1928. Dr. Herbert Osborn Jr. found that this *Tetrastichus* was abundant in Puerto Rico, not only being present in egg-clusters laid between the leaves of "jagüey" (*Ficus stahlii*) growing along the margins of certain fields of Central Aguirre at Santa Isabel, where he

made his first collections in 1932, but generally thruout the Island. In conducting "The Citrus Pests Investigation in the Windward & Leeward Islands, British West Indies, 1937–1942" (Imperial College of Tropical Agriculture, pp. 66, pl. 2, ref. 20. Port-of-Spain, August 1942), Mr. R. G. Fennah found this and *Tetrastichus marylandensis* Girault present in many of the Lesser Antilles. Neither occurs in Barbados, but attempts at introduction from Puerto Rico failed because the female parasite was unable to parasitize the eggs when laid between the tough tips of cane leaves; an almost universal place of oviposition by *Diaprepes* females there, but comparatively rare in Puerto Rico.

Dr. Alexander Wetmore, in conducting his survey of the economic food habits of the "Birds of Porto Rico" (Professional Paper, Bulletin No. 326, U. S. D. A., pp. 1–140, pl. 10. Washington, D. C., 1916), was possibly most successful in showing the value of birds when dealing with *Diaprepes abbreviata*. To be sure, the insect is not controlled by birds, otherwise it would not be an economic pest, but birds eat large numbers of adults and certainly prevent its being a more injurious pest. The weevils occur not only in cane fields, where birds are comparatively scarce, but more abundantly in field margins, in the trees along roadways and on forest margins, or in upland pastures reverting to forest, just such habitats as are preferred by most land birds. He found that it constituted 18% of the stomach contents of the petchary, 17% of the kingbird, 11% of the flycatcher, 10% of the mozambique, 7% of the ani, 2% of the owl and nearly 2% of the yellow-shouldered blackbird. Dr. Stuart T. Danforth noted the abundance of the beetles in the environs of Cartagena Lagoon, and that they were eaten by the owl, the mangrove cuckoo, the oriole and the ani. They are somewhat large to be eaten by lizards, but the crested lizard, *Anolis cristatellus*, eats many of them. The introduced Surinam toad, *Bufo marinus*, finds them not as easy to catch as May beetles, for they do not return to the ground after the first emergence from their pupal cell, and fall to the ground only when disturbed, nor are they nocturnal, like the May beetles. At periods when May beetles or other black Scarabaeid beetles are abundant, the toads concentrate of these more readily available items of food, but at other times they may eat considerable numbers of vaquitas. No such notable reduction in the abundance of *Diaprepes* followed the introduction of the toad as was the case for May beetles, however, indicating the comparatively minor role played by the toad in their natural control. Nevertheless, coincident with the scarcity of toads in the last few years, such large numbers of *Diaprepes* grubs occurred in some fields on the south coast during 1948 and 1949 as to cause serious losses. Large amounts of crude benzene hexachloride containing 12.5% of gamma isomer were applied in some of these fields at the rate of eight pounds per acre. This

amounts to only one pound per acre of gamma isomer, an amount insufficient to kill grubs, in any stage of growth. White grubs are somewhat more susceptible to the new insecticides than are the legless *Diaprepes* grubs, and for heavy infestations of large grubs in the soil, not less than

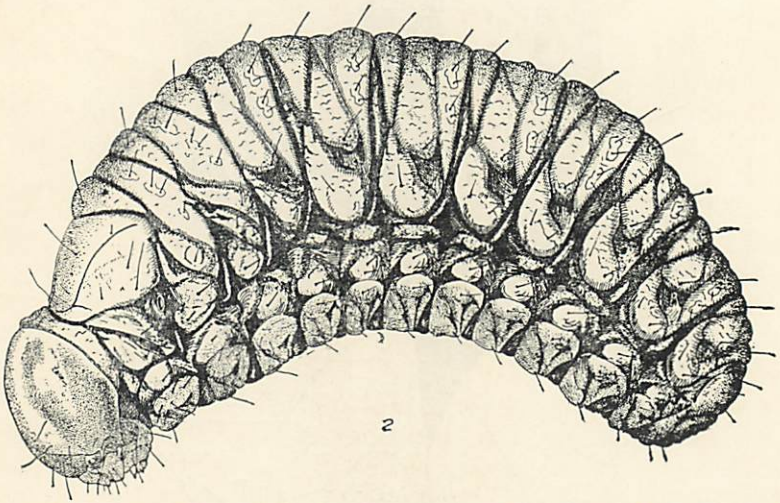


Egg-clusters of *Diaprepes abbreviata* L., between leaves of "jobo" (*Spondias mombin*), twice natural size. (Drawn by Francisco Seín.)

two pounds per acre of aldrin or two pounds of lindane must be used. Preliminary tests indicate that *Diaprepes* adults are readily killed by spraying infested host trees with 1% chlordan or 1% dichlorodiphenyldichlorethane (DDD), and it may be presumed that several of the other new insecticides will prove equally or even more effective. Infested citrus trees should not be sprayed with DDT however, as by destroying scale insect parasites, the eventual result is a mass infestation by scale insects

made more difficult to control because biological control has ceased to function.

As was abundantly proved in working out "The Life History of *Diaprepes abbreviatus* L., at Río Piedras, Puerto Rico" (Jour. Agr. Univ. P. R., **20** (4): 883–914, fig. 5, ref. 21. Río Piedras (October 1936) January 1937), the fungus *Metarrhizium anisopliae*, or the "Green Muscardine," takes a heavy toll on larvae, pupae and adults, at least in captivity, and may be presumed to do so also in the field, when conditions are favorable for its development. Indeed, it may be considered an indication of the inherent vitality of the insect that despite all the various factors of natural control, it still seems to be as abundant in Puerto Rico now as at any time in the past.

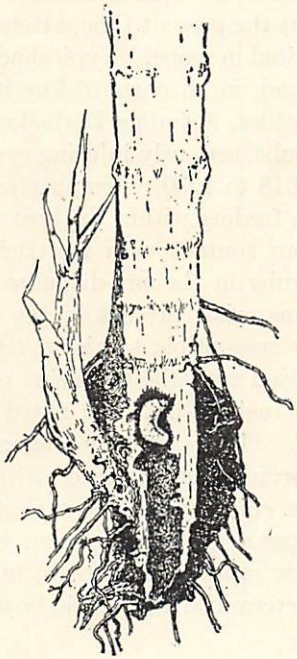


Larva of *Diaprepes abbreviata* L., five times natural size. (Drawn by H. Bradford.)

The oval-elongate eggs of *Diaprepes abbreviata* are laid in clusters of varying size between the tougher leaves of numerous trees, more especially those on the tender leaves of which adults are feeding, but possibly quite as often between the leaves of trees uneaten by adults. Comparatively rarely in Puerto Rico are the eggs laid between the split tips of the leaves of sugar-cane, but as suggested by Mr. Fennah, that "Otiorhynchids Oviposit between Paper" (Jour. Ec. Ent., **26** (6): 1172–3. Geneva, December 1933) indicates that "places for egg-laying are chosen on account of their physical attributes of flatness, stiffness, and opposability of plane surfaces." A thin film of sticky, transparent plastic surrounds the cluster on all sides, holding the two opposed leaves together no matter how slippery they may be, but as this film hardens, it loses much of its sticking power, enabling the

hatching grubs to escape from between the leaves upon hatching. It is such a powerful adhesive, however, that when the eggs are laid between paper, chosen in preference by the females rather than any kind of leaves, the grubs can not escape. This suggests a method of partial control that might prove practical in a young citrus nursery.

The variability in behavior essential to survival is at once displayed by the grubs in "The Larval Period of *Diaprepes abbreviatus* L." (Jour. Dept. Agr. P. R., **17** (3): 257–64, pl. 1, ref. 2. San Juan, November 14, 1933),



Larva of *Diaprepes abbreviata* L., in rootstalk of sugar-cane, one-half natural size. (Drawn by Francisco Seín.)

and more noticeably in "The Diapause Portion of the Larval Period of *Diaprepes abbreviatus* L." (Jour. Agr. Univ. P. R., **18** (3): 417–28, fig. 2, ref. 1. Río Piedras, October 27, 1934). Altho most often noted boring in the root-stalks of sugar-cane, the grubs have been found in the tubers of "ñame" and "yuca," in seed corn just beginning to sprout, and in the tap-roots of seedlings of pepper, papaya, grapefruit and mahogany. It may be presumed that they feed on any kind of live roots or tubers available, by preference chosing those of sufficient size that they may bore within them, rather than feeding from the outside, as do white grubs.

The adults feed on the leaves of sugar-cane, cotton, citrus, coffee and all

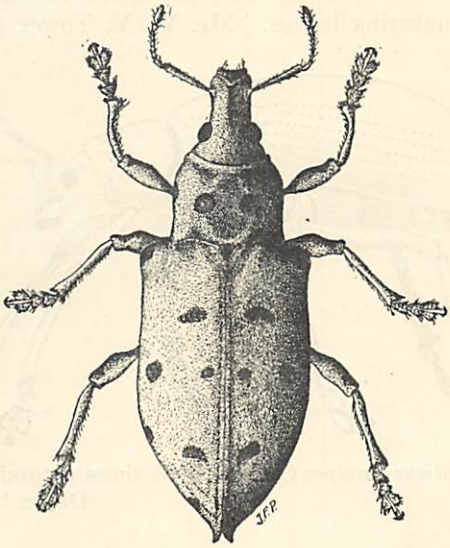
kinds of native and imported vegetables, as well as of practically every endemic and foreign tree. Those feeding on leaves sprayed with arsenicals or barium fluosilicate may be killed, but the effect of DDT is mostly as a repellent, causing them to chose some other unsprayed tree on which to rest, copulate and feed. Handpicking from pigeon pea bushes planted between cane fields is extensively practised in Barbados, but is hardly practical in Puerto Rico, where so many other kinds of vegetation offer equally attractive shelter for the adults. Hand collection of the grubs was at one time extensively attempted at Guánica in connection with the hand collection of white grubs, but at the present time, attempts at control in Puerto Rico are sporadic and limited in scope. Typical adults have been collected in Hispaniola, Mona Island, in all parts of Puerto Rico, on Vieques and in most of the Lesser Antilles, including Barbados.

Recent outbreaks of grubs, seriously injuring cane fields on the east and southern coasts during 1948 to 1950, re-emphasized the need for effective chemical control. Grubs feeding within the host plant are naturally protected by its tissues from contact with insecticidal chemicals, and the migrating fully-grown grubs in the pre-diapause period are remarkably resistant to extraneous materials present in the soil. The just-hatched grubs, however, are very susceptible to aldrin (Hyman 118), as little as half a pound per acre mixed with the soil being effective in killing them, and no diminution in its toxicity has been noted after being mixed with soil for a year and a half. Others of the newer insecticides are much less toxic, *Diaprepes* grubs surviving in soil mixed with 2 lbs. of chlordan, but not with as much as 5 lbs. chlordan, 10 lbs. of rhothane (DDD), or 20 lbs. of DDT. Ten pounds per acre of the gamma isomer of benzene hexachloride somewhat retards rapidity of growth, but the amount requisite for control has not been determined, and would be commercially impractical for commercial use.

Diaprepes capsicalis Marshall (1922–59), listed also by Dr. Blackwelder (1947–803) as an *Exophthalmus*, has the "integument black or piceous, fairly densely clothed above and below with brown or brownish-grey scaling, often with a coppery reflection; elytra with a pale dot about the middle of interval five. Length, 8–12 mm." It has been found only in Puerto Rico. Described from material collected by Dr. Richard T. Cotton at Río Piedras feeding on the foliage of garden peppers, it is possibly more abundant in the mountains, having been noted eating "fresas," the fruit of *Rubus rosaefolius*, at Jájome Alto, and also on the ground under fresa bushes at Jájome Alto a year later; on the ground in a sweet potato field being plowed at Cidra; intercepted at Jayuya, and on carrots at Villalba. Concerning a long series of unlabeled specimens in the collection at Río Piedras, one can only surmise as to the identity of the collector and the data of their collection. In the stomach contents of an ani, shot at La

Florida by Dr. Luis F. Martorell, was found the remains of one of these beetles.

Exophthalmus quindecimpunctatus Olivier (1807–300), described from Puerto Rico and known only from there, listed by Chevrolat (1876–227) and by Drs. Gundlach and Stahl as a *Prepodes*, was first noted in recent times by Dr. Luis F. Martorell in August 1940 eating the foliage of "corcho prieto" (*Torrubia fragrans*), on the mountain road to Maunabo from his home town of Yabucoa, and subsequently found in even greater abundance in October and December of the same year on the same host. It is quite possible that Olivier had but a single specimen in hand when preparing his

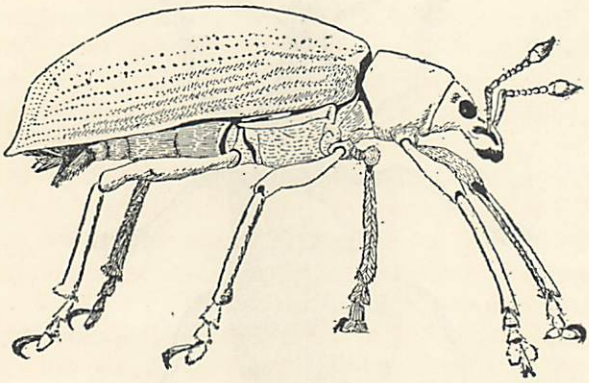


The Corcho Prieto Weevil, *Exophthalmus quindecimpunctatus* Olivier, four times natural size. (Drawn by José F. Pietri.)

description, for the number of spots varies depending on the amount of denudation of the beautiful iridescent metallic green scales from the black integument. Four black spots are usually to be noted on the prothorax, two above and one at each side; on each elytron are from five and one-half to eight and one-half, each spot quite round and distinct if present at all. Host trees have a much wider distribution in Puerto Rico, but no beetles have been found on trees at other points on the Island, except most recently at the mountain pass of El Collao, between Cayey and and Salinas, thirty miles distant from Yabucoa.

Exophthalmus roseipes, described by L. A. Auguste Chevrolat (1876–ccxxvii) as a *Pachnaeus* and thus listed by Drs. Stahl and Gundlach, is another even more beautiful endemic weevil, found nowhere else than in

Puerto Rico. Unrubbed specimens are completely covered with light Niagara green scales; beneath and on antennae and legs silvery white, with the integument of the legs possibly sufficiently light-colored and roseate to merit the specific name given by Chevrolat. The beetles are lighter in color than the very tenderest of the citrus leaves on which they are most often noted feeding, and on which they may at times become an economic pest, but also occur on the leaves of such other beach shrubs as seagrape and icaco, and are possibly a most perfect match on the more tender leaves of *Dalbergia ecastophyllum*. Adults in captivity eat their own weight of leaves daily, thus despite their comparatively small size, when at all abundant in citrus groves, their attack on tender leaves becomes noticeable in the maturing leaves. Mr. W. V. Tower (1911–9) records



Exophthalmus roseipes Chevrolat, six times natural size.
(Drawn by G. N. Wolcott.)

their scarring of young fruit, but this is exceptional, and only their very exceptional abundance would justify spraying with arsenicals or DDT to prevent attack. Dr. Wetmore found none of these beetles eaten by any of the birds he collected, but they doubtless do form an important item in birds, food at the seasons when they appear. Mrs. Raquel Dexter (1932–5) found them eaten by the introduced toad, and they are unquestionably eaten by the lizards inhabiting citrus trees in sandy areas, or beach shrubbery.

Hylobius pales Boheman, as identified by Dr. E. A. Chapin, was intercepted in a room in San Juan. This is not a tropical insect, being found from Nova Scotia west to Lake Superior and south to Florida, adults living in and beneath the bark of pine trees, the larvae destroying the inner bark and the tender, newly-formed wood beneath.

Heilipus ustulatus, described from Puerto Rico by Antoine G. Olivier

(1807–198) and not since found elsewhere, was not listed by Drs. Stahl or Gundlach.

Anchonus suillus Fabricius, described originally from the Island of St. Barthélemy, was listed by Dr. Gundlach from Puerto Rico, and has been found since all around the Island, under boards or decaying wood on the ground. When collections of *Cosmopolites sordidus* were being made at Río Piedras from slices of banana corms, these dirty, black beetles were often found accompanying the larger, shiny black ones. Presumably they are more abundant than the scarcity of records would indicate, for they were found by Mrs. Dexter to have been eaten by the introduced Surinam toad, and they have also been found eaten by the crested lizard, *Anolis cristatellus*, and by the introduced bullfrog, *Rana catesbeiana*.

Genonotus angulicollis, described as an *Anchonus* by L. A. Auguste Chevrolat (1876–ccxxviii) from Puerto Rico, and not since found elsewhere, was listed by Dr. Gundlach. The punctures on its elytra alternate with elongated warts with erect reddish-brown elongate scales; prothorax, beak and legs consist entirely of closely-set punctures. It has been found under the loose bark of a coffee shade tree, *Inga vera*, at Cayey, and under the dead bark of a tree on El Yunque.

A beetle identified as a species of **Sternechus**, as identified by Mr. L. L. Buchanan, was intercepted by Mr. R. G. Oakley on *Casearia* at Ponce, and others intercepted by him at Ponce on pomarrosa and on *Senegalia* flowers as species of **Smicronyx**.

Derelomus albidus, a Cuban weevil described by Suffrian, was listed from Puerto Rico by Dr. Gundlach. What may be the same was listed as a species of *Phyllotrox* from Puerto Rico by Dr. Alex. Wetmore as having been eaten by the "reinita" or honey creeper, *Coereba portoricensis*.

Cylas formicarius Fabricius, "el Piche de la Batata," occurs in all of the Greater Antilles and India, but to date, not in the Lesser Antilles. It is unquestionably the most serious pest of sweet potatoes in Puerto Rico, causing many tubers to be unsalable in the market if at all infested, and rejected for food for either man or beast if the infestation is at all general. Because the yellow, sweeter and more palatable varieties are greatly preferred by the piche, the general public, in purchasing the tubers in the market in quantities, discriminates against these more desirable kinds and accepts for human food the tougher, white varieties which are less nourishing because they contain less of carotine and consist mostly of fiber. The older and larger subterranean stems of the goat's foot morning-glory, a common weed tying together the sand on all beaches not regularly invaded by high tides, is also infested by the piche, making doubly difficult any attempt at control. The primary reason, however, why control is so difficult is that the bulk of sweet potato production is by small farmers, who

use the field as a storehouse of unharvested food, taking from it the larger tubers only as needed, and finally abandoning the field when most of the tubers are too badly infested. So far as known, the piche has no natural enemies and certainly no specific parasites.

The adults developing from several larvae in a single tuber need not even leave its protection to mate and continue a second generation, until it is completely destroyed by the feeding tunnels. Dr. Richard T. Cotton observed "*Cylas formicarius* Fabr. in Flight" (Jour. Ec. Ent., **9** (5): 516. Concord, N. H., October 30, 1916) in moving streetcars at night, and it had been previously noted at light in Río Piedras as early as 1912. When exceptionally abundant, adults may swarm in fields of sweet potatoes, eating stems, midribs and the larger leaf veins, and under such conditions are readily killed by the application of arsenicals or other insecticides. Normally, however, adults are rarely seen above ground. They attack roots or fresh tubers beneath the surface of the soil, gaining access by means of cracks. If carefully selected slips, free from infestation, are planted, these may escape early infestation if rainfall is abundant, but the effect of drought on the heavier soil is to produce cracks giving ready access for the weevils. Sandy soil is less subject to cracking during drought, and plantings of sweet potatoes on such soil are less subject to early infestation. In all cases, however, early harvesting of the tubers as soon as they have matured is advisable, while the prompt destruction of infested culls will do much to prevent infestation of the succeeding crop. The real problem in control in Puerto Rico is how to apply known measures of repression to the actual conditions of field practise, for as long as sweet potatoes are grown mainly as a subsistence crop by small farmers, effective control of the piche is impossible. The scientific specific name of the weevil is most appropriate, for the adults are definitely ant-like in appearance, with shining metallic blue elytra, black head, constricted prothorax and legs of chestnut red.

Apion martinezi Marshall (1935–516) was originally described by Sir Guy A. K. Marshall under the name *Apion xanthoxyli* (preoccupied by *xanthoxyli* Fall in Texas) as one of "New West Indian Curculionidae (Col.)" (Annals and Magazine of Natural History, **14** (10): 621–631. London, December 1934), the type from Guánica Forest, reared from seeds of West Indian satinwood or "aceitillo" (*Zanthoxylum flavum*), by Oscar R. Torres. It was found to be almost equally abundant by E. Martínez in the seeds from another aceitillo tree at Camp Buena Vista, Maricao, elevation 2700 feet. The integument of these beetles is red-brown, above with yellow-brown scaling, varying or interspersed with grey or whitish scales, below with whitish scales; length 2.0 mm., width 1.1 mm. For the foresters attempting to propagate aceitillo, this is a very serious pest, for from nearly half to sometimes all the seed is destroyed by the larvae burrowing in it.

Of the habits of the adults, nothing is known. The seed-producing trees are too high to be sprayed by any equipment locally available, and no attempt at control has been made.

Apion subaeneum, described by Carl E. A. Gerstaecker, the type from Puerto Rico, is synonymous with his **portoricanum** (Stett. Ent. Zeit., **15** 234–261, 265–280. Stettin, 1854). Mr. L. L. Buchanan is of the opinion that the *Apion* beetles intercepted by Mr. R. G. Oakley at Ponce, on flowers of the euphorbia "escambrón" (*Ricinella*) and on leaves of *Peiranisia* is of a different species from either of these.

Euscelus bipustulosus Jekel (1860–214), originally described as an *Attelabus* from Jamaica, is the determination of Dr. W. Dwight Pierce of the weevil leaf-roller of guava in Puerto Rico. As *Attelabus sexmaculatus*

The Guava Leaf-Roller, *Euscelus bipustulosus* Jekel, six times natural size. (Drawn by G. N. Wolcott.)

Chevrolat (1876–ccxxviii), the type from Puerto Rico presumably collected by Dr. Gundlach, it was listed by him and Dr. Stahl, and in Van Zwaluwenburg's list (P. R. 1024) feeding on *Psidium guajava* and *Eucalyptus*. Both specific names are equally applicable to these shining, reddish-brown weevils with spined and greatly expanded front femora, for they have two prominent golden pustules near the base of the elytra, and two additional golden spots laterally on each elytron. They occur in all parts of the Island where guava bushes grow, pairs coöperating in cutting strips of leaf tissue from the more tender leaves and rolling the strip up around the single egg until it forms a compact surrounding of nourishment for the larva. The egg is parasitized by *Poropoea attelaborum* Girault, a Trichogrammid wasp known only from rolls of these weevils. Altho guava foliage is normally preferred by these weevils, in nurseries of young eucalyptus, they may at times be-

come a serious pest, outbreaks having been noted on *Eucalyptus robusta* at Guavate, Cayey and at Patillas in 1940 and on *Eucalyptus citriodora* at Cayey in the same year. The tender leaves of the "almendro" (*Terminalia catappa*) have also been noted attacked at Río Piedras and at Bayamón.

Euscelus coccolobae Wolcott was described as an *Attelabus* ("IP" 1924–123) from paired adults which were feeding on and forming rolls of leaf tissue of seagrape (*Coccoloba uvifera*) about individual eggs, at Pt. Salinas. It is quite common on seagrape on all beaches, and on the leaves of "cucubano" (*Coccoloba laurifolia*) and "moralón" (*Coccoloba grandifolia*) in the interior of Puerto Rico. Shining, robust, dark purplish-red, their elytra with rows of deeply-impressed, quadrangular punctures, this Puerto Rican pest of seagrape differs from the Hispaniolan *armatus* Gyllenhal of seagrape most obviously in its blunter tooth posterior of the smooth area on the humerus. With stout, toothed femora and long, curved tibiae of the forelegs, they are well-fitted physically for rolling up a long strip of seagrape leaf tissue about the egg, the male and female working together to hold the strip tight until the drying of the tissue sets it in the desired position. They make no attempt to utilize the tough, older leaves, and even the tender tissue must be of just the right stage of pinkish-green tenderness for manipulation by the beetles. The leaf-rolls remain attached to the leaf indefinitely. Strips may dry too rapidly at mid-day and have to be abandoned, but at sunset so slowly that darkness sometimes overtakes the beetles still at work.

Myrmex pulicarius Boheman (1843–207), described as an *Otidocephalus*, the type from Puerto Rico, has been intercepted on "musgo" (*Pilea tenerrima*) at Adjuntas and on guava at Arecibo.

Anthonomus pulicarius Boheman (1843–219), the type from Puerto Rico, but found also in Hispaniola, is a minor economic pest, Mr. R. H. Van Zwaluwenburg (1916–45) noting it as "a very small, dark, long-snouted weevil in the flower buds of egg-plant." Dr. Richard T. Cotton (1918–300) naming it the "Eggplant Bud weevil," observed that it "feeds on leaves and breeds in the flower buds. Eggs are laid in young developing buds and the small white legless larvae develop within the bud, causing it to dry up and drop off." Control is more difficult because wild eggplant (*Solanum torvum*) may also be infested, but fortunately the insect is normally not very abundant, despite occurrence in all parts of the Island.

Anthonomus annulipes Fisher was described from Puerto Rico (1888–488), and listed by Dr. Gundlach, but has not been identified from local material since.

Anthonomus dentipennis Chevrolat, the type from Puerto Rico (1876–ccxxviii), probably collected by Dr. Gundlach, was listed by him with *A. krugi* Fisher (1888–487) in synonymy. Weevils doubtfully identified by

Mr. A. J. Mutchler as being this species were collected by Dr. Stuart T. Danforth at Boquerón.

Anthonomus costulatus Suffrian, described from Cuba and found also in southern Florida, has been repeatedly intercepted on guava: at Adjuntas, Aibonito and Río Piedras, as identified by Mr. L. L. Buchanan.

Anthonomus flavus Boheman, the type from Guadeloupe, was identified by Mr. L. L. Buchanan as being the minute grey weevil reared by Mr. A. G. Harley at Mayagüez from the bright red cherries of *Malpighia glabra*. To what are presumably identical specimens, swept from foliage of the West Indian cherry, *Malpighia punicifolia* L., at Río Piedras, he gives only the generic name. The injury produced by the development of the immature stages of this weevil in the fruit resembles that caused by the plum curculio: a crescentric russeting scar on the skin and puckering of the flesh underneath. Oviposition has not been observed, but the maggot confines its feeding to one area, and the pupa is formed in a chamber close to the seed. The first indication of transformation to adult is the conspicuous blackening of the eyes.

Anthonomus nigrovariegatus Fisher, the type from Puerto Rico (1888–488), probably collected by Dr. Gundlach, has not since been identified.

Besides these named species of **Anthonomus** known to occur in Puerto Rico, extensive interceptions, especially by Mr. R. G. Oakley in the Ponce region, have accumulated material in the U. S. National Museum of which Mr. L. L. Buchanan recogniżes eighteen undescribed species. Apparently none is of economic importance, and none has been noted on cotton. The Mexican cotton boll weevil, *Anthonomus grandis* Boheman, found also in Central America, the southern United States, Cuba, and most recently in many sections of Haiti, is unknown to date in Puerto Rico.

Weevils intercepted by Mr. R. G. Oakley on flowers of "guácima" (*Guazuma ulmifolia*) at Ponce, and on flowers of the coffee shade tree (*Inga laurina*) at Adjuntas, were identified by Mr. L. L. Buchanan as a species of **Neomastix**.

Piazorrhinus sp. was the identification by Mr. L. L. Buchanan of weevils intercepted by Mr. R. G. Oakley at Ponce and Yauco.

A species of *Tychius* was listed by Dr. Alex. Wetmore as having been eaten by the cliff swallow.

Weevils intercepted at Ponce by Mr. R. G. Oakley on flowers of "escambrón" (*Randia mitis*) and of an "acacia" (*Senegalia*) were identified by Mr. L. L. Buchnan as a species of **Sibinia**, others from Ponce and Aibonito as a species of **Pyropus**, and some from *Ocotea* fruit at Adjuntas as a **Conotrachelus**.

Chalcodermus ebeninus Boheman is an entirely black, deeply punctured weevil first found on cowpeas at Río Piedras in 1912 by Mr. Thos. H.

Jones, of which identification was made by Dr. E. A. Schwarz. It was listed by Mr. R. H. Van Zwaluwenburg (1513), but this refers to the Río Piedras record, and the insect seems to be localized, normally not abundant, yet at times so numerous that half the cowpeas will be infested of those harvested from a single field. Because of its normal scarcity, no precautions are taken to prevent infestations of succeeding crops, and ordinarily none is necessary.

Chalcodermus pupillatus Suffrian is a Cuban weevil first reported from Puerto Rico by Dr. Alex. Wetmore, having been found by him eaten by the mozambique. Dr. Stuart T. Danforth found it eaten by the pewee, and he had numerous specimens, as determined by Mr. A. J. Mutchler, collected at Mayagüez, Boquerón, Cabo Rojo, Yauco and Cartagena Lagoon. A weevil intercepted by Mr. R. G. Oakley on cotton at Ponce was identified by Mr. L. L. Buchnan as being a different species of *Chalcodermus* from either of these two named species.

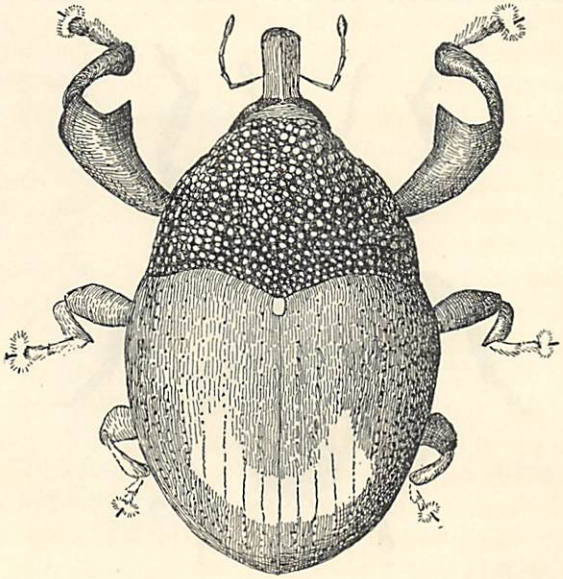
A species of **Rhyssomatus** was reported by Dr. Alex. Wetmore as being eaten by cuckoos and the ani, and specimens were intercepted on *Peiranisia* at Ponce by Mr. R. G. Oakley.

Nettarhinus mannerheimi was described by Francis P. Pascoe (1844–30) from Puerto Rico.

Pseudomopsis cucubano sp. nov., is oval, yellowish fawn to dark brown, length 5.0 mm. width 3.0 mm. Beak somewhat curved, shining, reddish brown, tending to become scaly and roughened towards the base (as is the head), in repose sunk deep in pectoral grove extending into the metasternum; antennae slender, elbowed, the scape as long as segments two and three combined, club elongate oval, the segmentation not marked. Eyes contiguous in front, coarsely faceted, in repose apparently subtriangular, partly covered behind. Circular light grey scales thickly, evenly but with no systematic arrangement cover the dark brown prothorax, wider than long but not as wide as elytra. Scutellum light grey, small but prominent. Elytra oval, narrowed towards base, yellowish fawn, irregularly darker towards margins; intervals 1 to 5 with whitish postmedian bands forming a crescent, broadest towards points. Intervals level, striae distinct, punctures near base as far apart as width of intervals, closer approaching apex. The first ventral segment of the abdomen most widely separates the coxae of the hind legs, its width equal to that of the next three combined and somewhat more than that of the fifth, all with light grey scales except apex of fifth, pygidium not exposed. Front femora prominently toothed. Described from six adults, reared from infested seeds of "cucubano" (*Coccoloba laurifolia*) or "ortegón" (*Coccoloba borinquensis*) at Garrochales (Arecibo), collected December 16, 1943 by Mr. José Marrero, the adults beginning to emerge from the seeds about March 20,

1944; generic determination by Mr. L. L. Buchanan, P. R. Acc. No. 112–44, other specimens in the U. S. National Museum intercepted by Mr. R. G. Oakley on *Coccoloba laurifolia* at Yauco and Ponce, not seen in preparing the description.

Pseudomus militaris, described as a *Rhynchaenus* by A. G. Olivier ("Entomologie" V. No. 83, p. 145. Paris, 1807), the type from Puerto Rico, has not since been collected, but weevils of this genus, as identified by Mr. L. L. Buchanan, have been collected on El Yunque by Dr. Luis F. Martorell, and intercepted by Mr. R. G. Oakley on decaying palms and



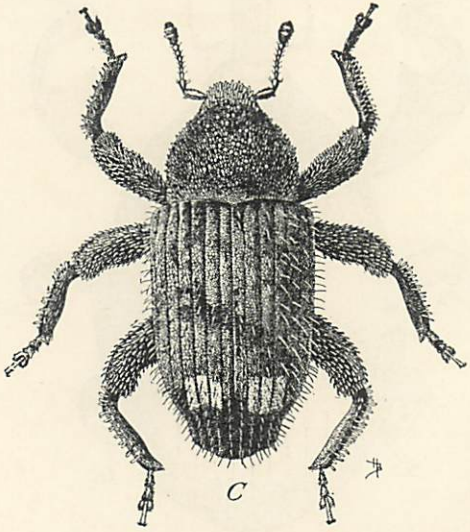
The Cucubano Seed Weevil, *Pseudomopsis cucubano* sp. nov., fifteen times natural size. (Drawn by G. N. Wolcott, original.)

on dead wood in the mountains back of Ponce, at Indiera, Guayanilla, Adjuntas and Villalba. These are comparatively large weevils, 7 to 8 mm. long, black and deeply punctured, with conspicuous whitish areas posteriorly on the elytra, and smaller ones elsewhere.

Euscepes porcella, described by Carl H. Boheman in Schönherr's "Genera et Sp. Curculionidum" (4 (1): 430. Paris, 1844), the type from Puerto Rico, has an extensive distribution in the West Indies, Central America, Mexico and southern Florida, where it is found "common beneath decaying stems of the water hyacinth next to the water's edge". It has been little collected in Puerto Rico except by birds, Dr. Alex. Wetmore having found it in the stomach contents of the cliff swallow, vireo, redstart,

ovenbird, three warblers, the honey creeper, yellow-shouldered blackbird, oriole, mozambique and grasshopper sparrow. According to Blatchley & Leng (1916–189), it is "brown, densely clothed with dark brown and clay-yellow scales, the latter covering the basal and apical thirds of elytra".

Euscepes postfasciata Fairmaire, much better known under the name of *batatae* Waterhouse, under which it was re-described a year later, is the "scarabee" of sweet potatoes in the British Islands. It is by far the most serious pest of sweet potatoes in Barbados, and in some of the other Lesser Antilles, but in Puerto Rico is of minor importance by comparison with the "piche" (*Cylas formicarius*). First recorded from Puerto Rico by Van



The "Scarabee," *Euscepes postfasciata* Fairmaire, fourteen times natural size. (Drawn by Harry Bradford.)

Zwaluwenburg in his list (926) at Mayagüez on sweet potatoes and pomelo rind, it has most often since been noted in the Mayagüez region, with individual records from Arecibo, Río Piedras and Guayanilla. Mrs. Raquel Dexter found it eaten by the Surinam toad, but Dr. Wetmore found it eaten by no bird, and apparently it is too rare to be eaten by them or by lizards. It is readily distinguished from *Euscepes porcella* by the light colored scales being limited to a rectangular area of three intervals on the posterior third of the elytra.

In studying the "Birds of the Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1931), Dr. Stuart T. Danforth includes in the grass association a leguminous herbaceous

shrub: "sesbania" (*Sesban emerus*), which is attacked by a weevil, **Tyloderma** sp. Despite its importance in his studies, for these weevils form a more or less appreciable factor in the food of sandpipers, the killdeer, ani, kingbird, yellow-shouldered blackbird, waterthrush and parula warbler, it has never been more exactly identified, the indefatigable Mr. Oakley never intercepted it in recent years, and Dr. Wetmore does not report it as forming an item of food for the birds that he collected.

As this weevil appears to be still unnamed and undescribed, I am calling it **danforthi,** describing it from material loaned by Prof. J. A. Ramos, collected January 1935 at Cartagena Lagoon by Mr. V. Biaggi. Of uniform size, 5.0 mm. long and 2.2 mm. wide, it is larger than any species of *Tyloderma* from the eastern United States except *foveolata* Say, which varies in size from 3 to 5.8 mm., and is otherwise quite distinct, listed by Mr. W. S. Blatchley and Dr. C. W. Leng (1916–491) from Florida, "in stems of the evening primrose." All mature specimens are dark reddish-brown, highly polished above, below dull; thorax impunctate but with scattered silvery hairs, plump pear-shaped, much longer than wide, rounded in front, widest a third of the distance from the base, concavely constricted above forelegs and behind eyes, slightly so even on vertex; elytra becoming parallel and straight at sides before base, sparsely and unevenly pubescent, evenly and deeply punctate, appearing furrowed on disc and towards apex.

Gasterocercus richteri Fischer, the type from Puerto Rico (1888–154), has not since been found.

Coelosternus armipes Boheman, known also from St. Vincent and Guadeloupe, is "A Little-Known Root-Weevil of Cassava (*Coelosternus sulcatulus* Boheman)" (Jour. Dept. Agr. P. R., **14** (3): 159–163, fig. 1, pl. 3. San Juan, August 1930) which Dr. M. D. Leonard found at Comerío and on which he made life-history studies. More recently it has been found at Río Piedras, but in such small numbers that economically it is of negligible importance.

Numerous collections have been made of weevils belonging to the genus **Cryptorrhynchus** of which individuals vary so much in size and markings that no specific names have been assigned to them. One species is reasonably common on bark of coffee shade trees in the mountains, and possibly represents a single species.

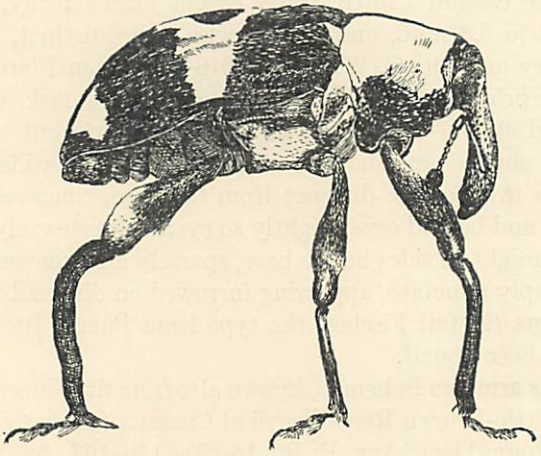
Lechriops psidii, described by Sir Guy A. K. Marshall (1922–69), the type from Puerto Rico, 2.0 mm. long, 0.9 mm. wide, is reddish-brown, densely covered with white, buff or yellowish brown scales. Reared from mummied guava fruit, it is one reason why *Psidium guajava* yields so little marketable fruit in Puerto Rico, for this little weevil occurs everywhere in the Island that guava bushes grow.

A weevil intercepted by Mr. R. G. Oakley in dead bark at Guánica was

determined by Mr. L. L. Buchanan as a species of **Copturus,** and one on "guácima" (*Guazuma ulmifolia*) at Boquerón as a species of **Tachygonus.**

Hypurus near **bertrandi** Perris is the redetermination by Mr. L. L. Buchanan of weevils reared by Mr. Thos. J. Jones from larvae mining in the leaves of portulaca, which Dr. E. A. Schwarz had originally identified as a new species of *Hypocoeliodes*. Mr. R. G. Oakley recently intercepted adults in the seed pods of a weed at Ponce.

Auleutes inspersus Champion was the determination by Sir Guy A. K. Marshall of weevils which Dr. Stuart T. Danforth found on *Jussiaea* at Mayagüez in October 1932, and had earlier found at Cartagena Lagoon,



Peridinetus signatus Rosenschoeld, six times natural size.
(Drawn by G. N. Wolcott.)

Caguas and at Las Marías. Numerous other beetles of this genus and possibly this species have been intercepted on a variety of other hosts.

"Allied to *Auleutes* and more closely so to *Hypocoeliodes*, but differing from both by the huge eyes, the more slender, subcylindrical, feebly-sculptured rostrum which rises abruptly from the head" is *Panophthalmus* "A New Genus and four new species of West Indian Curculionidae" (Mem. Soc. Cubana Hist. Natural, **10** (3): 145–152. Habana, 1936) erected by Mr. L. L. Buchanan to include **Panophthalmus puertoricanus,** of which the type was intercepted by Mr. R. G. Oakley, at Juana Díaz. It is 2.3 mm. long, 1.68 mm. wide, its dark "body clothed with minute, fuscous and golden subrecumbent hairs and setae and white scales; pronotum with large, medio-basal patch of scales; elytra with a transversely rectangular patch of scales and other scattered spots".

Peridinetus concentricus Olivier (1844–207), *Peridinetus maculatus* Rosenschoeld (1837–471) and **Peridinetus signatus** Rosenschoeld (1837–472) are names all of which presumably refer to the same distinctively marked beetle, which makes round holes in the leaves of "higuillo" (*Piper* spp.) and of which the larvae bore in the stems of the same host plants. It occurs in all the more humid regions of the Island where the host plants grow, as well as in Hispaniola and Cuba. In tropical South America, the same or similar hosts are to be noted with identical round holes in their leaves, eaten by adults varying only in degree of yellowish shading from the more sharply marked species of the West Indies. Chevrolat gives Olivier's name, but Dr. Gundlach lists this in synonymy with *signatus*; and *maculatus* separately. If *maculatus* is a distinct species in Puerto Rico, no specimen has been identified from here since the type collection. Dr. Stahl lists only *signatus*, and this is in Van Zwaluwenburg's list (P. R. 36): on *Piper peltatum*. Despite the comparative abundance of the beetles, there are no records of their being eaten by birds, lizards or the toad, but their escape may be due to their retiring habits, certainly not because of their conspicuous coloration.

Baris torquata Olivier, described as a *Rhynchaenus*, the type from Puerto Rico (1807–145), is a somewhat smaller but even more conspicuous weevil of shining black with extensive areas of dense white scales. Listed by Chevrolat and Drs. Gundlach and Stahl, it was noted by Dr. Wetmore as eaten by the cliff swallow and the mozambique, and it has since been found eaten by the crested lizard, *Anolis cristatellus*. Dr. Richard T. Cotton calls it (1918–300) the "Eggplant Stem Borer: a pest of both wild and cultivated eggplant. The adult feeds on foliage, the female lays small, white, oval eggs in a crescentric slit in the stem; the larva bores in stem and branches". It occurs only in Puerto Rico, but has been noted on its specific hosts in all parts of the Island.

Geraeus montanus sp. nov. Rhomboidal, convex. Black, with oval areas of dense white scales near base of elytra covering intervals 2 to 7; smaller, narrower transverse area two-thirds towards apex on intervals 3, 4 and 5; most conspicuously scaled also on apical half of episternum; prosternum, lateral margins of 3d and 4th abdominal segments and legs grey with less dense whitish scaling. Beak, large, stout, black, one-third length of body, curving at angle of 45° at middle; head impunctate, shining; eyes, large, dull black, not contiguous. Thorax closely and finely punctate, one-third wider than long. Elytra oval, with humeral angles distant from base, elytron three times as long as wide, deeply striate and closely punctate, intervals convex. Length, 2.7 mm.; width 1.2 mm.

Described from numerous adults on flowers of "botoncillo" (*Borreria verticillata*) at Barros (Matrullas Dam), October 10, 1939, which Mr. L.

L. Buchanan placed in the genus *Geraeus* and stated to be the same as others intercepted by Mr. R. G. Oakley at Villalba previously identified as a species of *Centrinus*. On May 1, 1940, Dr. Donald De Leon and Dr. Luis F. Martorell found additional specimens (and other weevils) on the flowers of 'inmortal" (*Helichrysum bracteatum*) at Doña Juana Camp, Villalba, but these and those collected by Mr. Oakley at Villalba were not seen in preparing this description.

Diorymerellus politus Chevrolat (1880–307), with priority over *D. obliteratus* Champion (1908–252), the identification by Sir Guy A. K. Marshall of the first specimens sent from Puerto Rico, is an entirely black and very shiny weevil first found in the flower bracts of orchids on El Yunque and subsequently becoming a pest of vanilla of sufficient importance to merit notice in the Mayagüez Station Report for 1938 (p. 119).

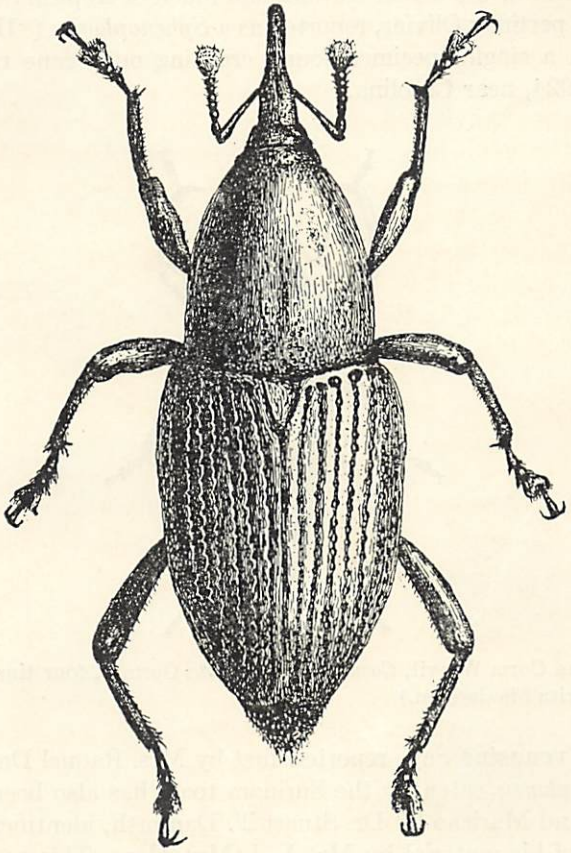
Anacentrinus sp. was the determination by Mr. L. L. Buchanan of weevils taken from the flowers of wild parsnip at Cayey in 1939.

Zygobaris sp. was the determination by Mr. L. L. Buchanan of weevils intercepted by Mr. R. G. Oakley on *Matayba*; those on pomarrosa at Ponce and on flowers of *Senegalia* at Ponce, represent two distinct species of **Catapastus.**

Ampeloglypter cissi was the name given by Sir Guy A. K. Marshall (1922–70) to some little Puerto Rican weevils with the "color uniform dark steel-blue above, the head, rostrum and lower surface blue black; length 2.0 mm.", found feeding on tender shoots of wild grape (*Cissus sicyoides*) at Río Piedras, July 5, 1921. A few individuals have been noted at Río Piedras in succeeding years, but never in such abundance as at the time of the type collection.

Metamasius hemipterus Linnaeus was first recorded from Puerto Rico under the name *Sphenophorus sericeus* Latreille by Dr. Stahl, by Dr. Gundlach with the note "en los troncos muertos de plátano (*Musa*)", and by Mr. Aug. Busck (1908–89) as *Sphenophorus sexguttatus* Drury, injuring sugar-cane. In Van Zwaluwenburg's list (305) it is given as a pest in sugar-cane, coconut palm and *Lantana* sp. The rotten stalk borer of sugar-cane, or "el gorgojo de la caña podrida", is noted by Mr. D. L. Van Dine in all his accounts of the insects of sugar-cane as not a serious pest. Mr. E. G. Smyth (1919–142) in addition records it in "dead or injured palm trunks; in banana trunks, more rarely, with the adults sometimes attacking the fruit". It is a comparatively common insect, often coming to rest in an automobile, or noted in flight. Adults often alight on the sunny gallery of the agronomy building of the Experiment Station at Río Piedras. Dr. Wetmore found that the adults formed over 5% of the stomach contents of the mozambique and the kingbird, and smaller fractions of the food of the petchary, ani, oriole and yellow-shouldered blackbird, and Mrs. Raquel

Dexter that they are eaten by the Surinam toad. The Green Muscardine fungus, *Metarrihizium anisopliae*, also attacks the adults, as noted by Mr. J. A. Stevenson (1918–22), but is a comparatively minor factor in control. Field rats are of decisive importance in determining the abundance of this weevil, for the female normally lays her eggs in injured cane stalks that have been eaten by rats, and but rarely in such a minor injury as the

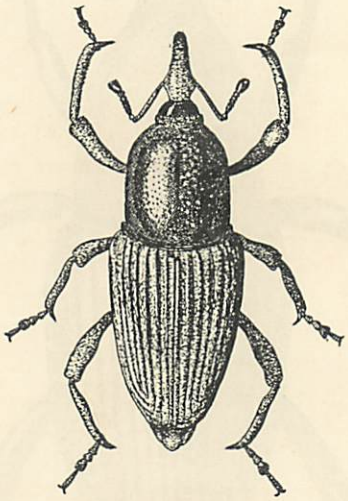


The Rotten Stalk Borer of Sugar-Cane, *Metamasius hemipterus* Linnaeus, eight times natural size. (Drawn by Francisco Seín.)

emergence tunnel of *Diatraea saccharalis*. As soon as the larvae have begun their development, the rotting cane stalk acquires a distinctive odor of acetic acid which becomes ever more pronounced as more of the stalk is infested. The larvae feed on the pith of cane, and when fully grown, wind about their bodies the long uneaten fibers to form a most characteristic pupal covering. All stages of development are often to be found present

in a single stalk, the lightly colored adults, half an inch long remaining within their pupal wrappings until they become fully darkened: black streaked with dark chestnut. Exceptionally, larvae may occur also in the stems of live banana plants, and adults feed on many kinds of decaying juicy vegetation, such as rotten fruits of mamey, papaya, mango, maga, guava and pineapple. The insect occurs in all parts of Puerto Rico, as well as in most of the Lesser Antilles and much of tropical South America.

Calendra pertinax Olivier, reported as a *Sphenophorus* ("IB" 1936–316), is based on a single specimen found crawling on a cane railroad track, March 1, 1924, near Carolina.

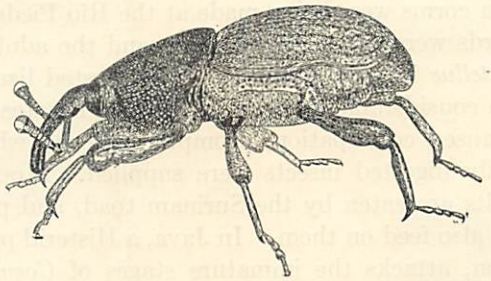


The Banana Corm Weevil, *Cosmopolites sordida* Germar, four times natural size. (Drawn by Fritz Maximilien.)

Calendra venustus Say, reported first by Mrs. Raquel Dexter (1932–5) as a *Sphenophorus* eaten by the Surinam toad, has also been collected at Mayagüez and Maricao by Dr. Stuart T. Danforth, identifications having been made of his material by Mr. A. J. Mutchler. This corn bill-bug or "elephant bug" has also been found in Cuba, and in the States "ranges from Maine to Wisconsin, south to Florida and Texas, common along the seashore of New Jersey" and often "taken beneath seaweed on the Gulf beach".

Cosmopolites sordida Germar, the banana corm weevil, was first noted in Bo. Malvilla, Vega Alta, in December 1921, but by early in 1922, it was found at Corozal, and in Bo. Cupey and at the Experiment Station at Río Piedras. Adults were identified by Sir Guy A. K. Marshall, who warned of the potential danger and recommended eradication if that were

still possible. The habits of adult and larva attacking the corm of live banana plants was ample indication of the advent of a new and serious pest, first known from the East Indies, and brought by man in infested corms to many of the countries of tropical America and Guadeloupe and Dominica of the Lesser Antilles. To date, this pest of bananas and plantains does not occur in Hispaniola, Cuba and Jamaica, naturally making the cost of production less in these islands than it is in Puerto Rico. Within the next few years after its first discovery at Vega Alta, it had spread to all the banana growing regions of the Island, Dr. Stuart T. Danforth having an abundance of specimens before 1930 from Mayagüez, Cabo Rojo, Yauco and generally in the mountainous areas of central and western Puerto Rico. Superficially, the legless grubs are indistinguishable from those of *Metamasius hemipterus*, which may at times occur in the still living portions of



The Banana Corm Weevil, *Cosmopolites sordida* Germar, four times natural size. (Drawn by Francisco Seín.)

the stalks of bananas, but normally lives only in decaying or rotting tissue, while the grubs of *Cosmopolites* are in living corms. The entirely black adults are readily attracted to slices of corms placed in infested groves, as are also to some extent the adults of the striped *Metamasius*, and by persistent collecting from freshly cut corms one may greatly reduce infestation. It is impossible, however, by such means to entirely eliminate infestation, and even the exceptional grower can not be induced to maintain collections when few adults are taken from his traps. Mr. Francisco Seín, experimenting with "Paring and Heat Sterilization of the Corms to Eliminate the Banana Root Weevil" (Jour. Agr. Univ. P. R., **18** (3): 411–16, pl. 1, fig. 2, ref. 2. Río Piedras, October 27, 1934), proved that placing the corms near a fire or submerging them in boiling water for a few minutes will not kill either eggs or larvae, but paring the corms eliminates the eggs and indicates the presence of the grubs in their tunnels. Such pared corms are very susceptible to reinfestation, and must be planted the same day in land not previously infested. Corms for planting may be freed from all stages of the weevil, without the bother and uncertainty of paring, and

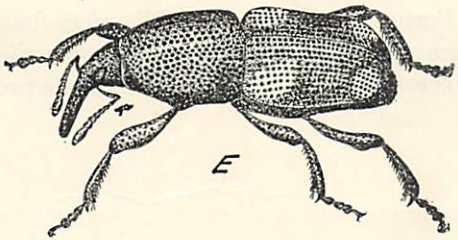
with no damage to the corm, by heat sterilization at 43°C. for EIGHT hours in a circulating atmosphere saturated with moisture. Such a sterilizer is somewhat expensive to construct, and can be used to advantage only by large growers, but its use avoids all danger of careless inspection, or not paring deep enough to eliminate all the weevils. Circular No. 103: "Para Combatir el Gorgojo del Plátano—Método de Mondar la Semilla" (Est. Expt. Agricola, pp. 5–11, pl. 1, fig. 2. Río Piedras, November 24, 1934) proved so popular that the entire edition of 2,000 copies was distributed in less than three weeks, and this method of control has proved so effective in practise that the growing of bananas and plantains is still possible everywhere in Puerto Rico that farmers have adopted these recommendations.

The accidental introduction of *Cosmopolites sordida* occurred after the investigations on the food of birds and of lizards had been completed. Collections from corms were being made at the Río Piedras Station, however, when lizards were being reared there, and the adults were supplied to *Anolis cristatellus* in large numbers. The crested lizards ate the hard black weevils in considerable numbers, at first, but a steady and exclusive diet of them caused constipation, promptly relieved when other, softer and more readily digested insects were supplied. Mrs. Raquel Dexter found that adults are eaten by the Surinam toad, and presumably some terrestrial birds also feed on them. In Java, a Histerid predator, *Plaesius javanus* Erichson, attacks the immature stages of *Cosmopolites* in their tunnels in the corms, and, as related in the Mayagüez Station Report for 1938 (p. 101), adults of this beetle were imported from Fiji. In captivity in Puerto Rico, the adult Histerids fed on both larvae and pupae of *Cosmopolites*, but no trace has since been found of those released in a banana grove at Adjuntas. Indeed, when search was being made for these introduced beetles, a native earwig, the variety *gagathina* Burmeister of *Carcinophora americana* (P. de B.), was found in the tunnels, and in captivity fed on the larvae of the weevil. The practical banana or plantain grower can not depend upon any of these factors in natural control, or all of them combined, but must use the methods devised by Mr. Seín if he is to continue producing a commercially profitable crop.

Sitophilus linearis Herbst, originally described from St. Barthélemy, was first reported from Puerto Rico by Dr. Gundlach, that it "come las semillas del tamarindo". So far as known, the seeds of the tamarind (*Tamarindus indica*) are the only host, and the weevils infest the seeds in most of the countries where this tree has been introduced. They occur in all parts of Puerto Rico, sometimes in such abundance as to form an item in the food of the crested lizard, *Anolis cristatellus*.

Sitophilus oryzae Linnaeus is a cosmopolitan pest of rice, noted in Puerto

Rico by Drs. Stahl and Gundlach, the latter adding "muy dañina por la destrucción de los granos del maíz". Besides causing enormous damage to its normal hosts of corn and rice, it has been found in a seed of "mamey" (*Mammea americana*) at Isabela, resting under dead bark of "bucare" (*Erythryna poeppigiana*) at Cayey, and intercepted at San Juan in dry chick peas, in ñame root and on tomato fruit, and at Carolina and Utuado in dry herbs. In international commerce, this weevil is imported and exported as an adult and in immature stages in its hosts, the record from Mona Island presumably due to the food supplies brought to that Island. Mr. O. W. Barrett (1905–396) at Mayagüez noted parasitism by *Pteromalus calandrae* Howard, and Dr. Wetmore reported finding this distinctively four-spotted weevil eaten by Latimer's vireo, both of which are insignificant factors in natural control. Mr. H. K. Plank, trying to find cheap, practical and simple methods for "The Control of Storage Insects in Corn Seed" (Jour. Ec., **39** (3): 314–19, fig. 1, ref. 8. Menasha, June 1946) notes that



The Rice Weevil, *Sitophilus oryzae* Linnaeus, ten times natural size. (After Cotton.)

"rolling the partly dry seed ears in hydrated lime gave the most satisfactory results" in maintaining viability and preventing attack by the rice weevil. In three or four days after harvest, the corn grains have dried sufficiently so that the lime, one part to forty parts of grain by weight, may be applied, the protection against attack thus afforded being better than when other dusts with known fungicidal properties are used, or the grain is fumigated with carbon bisulfide.

Nanus uniformis Boheman (in Schönherr), which Dr. Gundlach noted "se encuentra frecuentemente en la parte interior de una llagua de Palma real fresca", has subsequently been intercepted by Mr. R. G. Oakley in the pollen of a royal palm at Ponce.

The weevils intercepted by Mr. R. G. Oakley in rotten wood at Aibonito were identified by Mr. L. L. Buchanan as a species of **Micromimus.**

Cossonus canaliculatus Fabricius, first recorded by Leng & Mutchler from Puerto Rico, is a small black weevil which has recently been found under bark and chips of wood of "almácigo" (*Bursera simaruba*) at Salinas.

It occurs also in Trinidad, northern South America, Central America and Mexico, and of it *Cossonus vulneratus* Illiger is a synonym.

Cossonus impressus Boheman is the determination by Mr. A. J. Muchler of weevils collected on Mona Island for the American Museum of Natural History and listed in a "Supplement to Preliminary List of the Coleoptera of the West Indies" (Bull. Amer. Mus. Nat. Hist., **37** (5): 191–220. New York, February 13, 1917) by Dr. Charles W. Leng and Mr. Mutchler. Specimens collected by Dr. Stuart T. Danforth at Aibonito were thus identified by Mr. Mutchler, and Mr. L. L. Buchanan gave this determination to material intercepted in rotten wood by Mr. R. G. Oakley at Ponce and Aibonito.

Caulophilus latinasus Say was first reported from Puerto Rico by Dr. F. H. Chittenden as the "Broad-Nosed Grain Weevil" (Bur. Ent. Bull. ⁄96, pt. 2, pp. 19–24. Washington, D. C., March 31, 1911) when on "February 3, 1899, living beetles were found in equal numbers with the rice weevil in shelled corn and chick-peas (garbanzos) purchased in a store by Mr. August Busck at Arroyo, Porto Rico". Dr. Alex. Wetmore found it eaten by the honey creeper, since which time it has not been recorded here. Indeed, it is doubtful if it is established in Puerto Rico at the present time.

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[2] Leave to pursue advanced studies.
[3] Leave without pay.
[4] Military Leave.
[5] Soil Conservation Cooperative Project between P. R. Expt. Sta., SCS, BPISAE, OES-P.R. Sta.

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DIPTERA

Two-winged Flies

As early as 1794 and 1805, Fabricius named and described flies from the Island of St. Thomas in the Virgin Islands. The earliest extensive records of Diptera from Puerto Rico, however, are the determinations and descriptions published by Herr Victor von Roeder: "Dipteren von der Insel Portorico" (Stettiner Entomologische Zeitschift, 337–349. Stettin, 1885) of the collections made by Dr. Juan Gundlach. Those made by Mr. August Busck in 1899 were listed, or described if new, by Mr. D. W. Coquillett in a "Report on a Collection of Dipterous Insects from Porto Rico" (Proc. U. S. National Museum, **22**: 249–270. Washington, D. C., 1900). All of these earlier records are given by Dr. J. M. Aldrich in his "Catalogue of North American Diptera" (Smithsonian Misc. Collections, **46**: (1444): 1–680. Washington, D. C., 1905). Dr. F. M. Root, of the School of Hygiene and Public Health at John Hopkins University, primarily interested in mosquitoes and flies as disease vectors, published "Notes on Mosquitoes and other Blood-Sucking Flies from Porto Rico" (Amer. Jour. Hygiene, **2** (4): 394–405, fig. 5. Baltimore, July 1922) after an extended survey in person.

Dr. C. H. Curran began describing "New Diptera from the West Indies," all of which were from Puerto Rico (American Museum Novitates No. 220, pp. 1–14. New York, June 19, 1926), continued with "New Neotropical and Oriental Diptera in the American Museum of Natural History" (American Museum Novitates No. 245, pp. 1–9, fig. 1. New York, January 27, 1927), but did not complete his account of the "Diptera or Two-winged Flies" for the Scientific Survey of Porto Rico and the Virgin Islands, **11** (1): 3–118, fig. 38, ref. 19. New York Academy of Sciences, New York, 1928, as this was followed by a "First Supplement of the Diptera of Porto Rico and the Virgin Islands" (American Museum Novitates No. 456, pp. 23, fig. 4. New York, February 11, 1931) and by several other papers on the members of the Tachinidae, Dolichopodidae, and Syrphidae. Prof. O. A. Johannsen of Cornell University published descriptions of "New Species of Nemocera from Puerto Rico" (Jour. Agr. Univ. P. R., **22** (2): 219–225. Río Piedras, May 1938).

Tipulidae: Craneflies

Dolichopeza (Megistomastix) acutiloba is one of the "New or little-known Species of West Indian Tipulida (Diptera) II" (Jour. Agr. Univ. P. R., **21**(2): 179–190, pl. 1. Río Piedras, July 1937) described by Prof. C. P. Alexander from material collected by Don Julio García-Díaz on El Yunque while making "An Ecological Survey of the Fresh Water Insects of Puerto Rico" (Jour. Agr. Univ. P. R., **22** (1): 43–97, pl. 7, ref. 44. Río Piedras, April 15, 1938), and listed by him in his "Appendix A" (pp. 94–96).

Dolichopeza (Megistomastix) obtusiloba Alexander (1937–180) is also described from material collected by Don Julio on El Yunque: "general color brown, the praescutum with four paler stripes, length, 7.5 mm., characters very similar to those of *acutiloba*, differing especially in the structure of the male hypopygium."

Dolichopeza (Megistomastix) portoricensis, described (as a *Megistomastix*) by Prof. C. P. Alexander as "A Peculiar new Crane-fly from Porto Rico" (Psyche, **19**: 63–66, pl. 1. Cambridge, 1912) was also from El Yunque, collected by C. W. Richmond at an elevation of 2,800 feet, February 20, 1900. It is "the smallest Tipuline species in the Island", with "apically hairy wings, with a peculiar veination, and characterized by the greatly elongated antennae of the male."

Megistocera longipennis Macquart, first collected in Puerto Rico by Dr. Gunlach and noted by him "no es rara," was identified by von Roeder (1885-338) as a *Tipula*. Since Gunlach's time, however, it has not been collected in Puerto Rico, which seems rather surprising as it is "one of the two largest Tipulidae of the Greater Antilles" according to Prof. Charles P. Alexander, writing of "The Crane-Flies of Puerto Rico" (Jour. Dept. Agr. P. R., **16** (4): 347–387, p. 6. San Juan, February 1933).

Brachypremna unicolor described by Baron C. R. Osten Sacken in his "Studies on Tipulidae" (Berliner Entomologische Zeitschrift, **31**: 329–40. Berlin, 1887) from three males collected in Puerto Rico in 1835 by Herr C. Moritz, has not since been found here, altho abundant in Hispaniola and Cuba, and since recorded from Grenada.

Limonia (Limonia) hoffmani was named by Prof. C. P. Alexander in "Records and Descriptions of Neotropical Crane-flies (Tipulidae, Diptera) III" (Jour. N. Y. Ent. Soc., **35** (3): 265–6. New York, September 1927) for its collector, Dr. W. A. Hoffman, who first found it on El Yunque, and later at Villalba at an elevation of only 1,600 feet. Apparently it is quite common at the higher elevations, having also been found at Las Cruces, elevation 1,300 feet, and at Indiera, equidistant from Lares, Yauco and Maricao, in an abandoned coffee grove.

Limonia (Neolimnobia) diva (Schiner), was collected on El Yunque by Dr. M. D. Leonard, according to Prof. Alexander (1933-357), and was since found by Don Julio there.

Limonia (Dicranomyia) brevivena (Osten Sacken), subspecies **torrida** was described by Prof. C. P. Alexander (1933-358) from material collected at Puerto Real on Vieques Island by Dr. M. D. Leonard, "differing from typical *brevivena* O. S. chiefly in the details of body-coloration."

Limonia (Dicranomyia) distans (Osten Sacken), a Tipulid with "general coloration brown, with a sparse golden-yellow pollen" occurring from the southern United States to Paraguay, has been found by Dr. M. D. Leonard on Vieques Island, and at Río Piedras in Puerto Rico.

Limonia (Dicranomyia) divisa Alexander is a yellow Tipulid from eastern North America, "recurring in the mountains of Hispaniola and Puerto Rico," at El Yunque and Villalba.

Limonia (Rhipidia) domestica (Osten Sacken), occurs from the southern United States to Argentina, and has been noted at numerous localities in Puerto Rico, as well as on Vieques Island by Dr. M. D. Leonard. It is readily distinguished, according to Prof. Alexander (1933–360), "by the coloration of the antennae, the two subterminal segments being pale yellow, contrasting abruptly with the blackened remainder."

Limonia (Rhipidia) tetraleuca was described by Prof. Alexander (1937–182) from material collected by Don Julio García-Díaz on El Yunque, with "antennae brown, with four subterminal segments white."

Limonia (Geranomyia) antillarum Alexander has been collected at Coamo Springs, Villalba and elsewhere in Puerto Rico, and intercepted in a grapefruit grove at Bayamón, mis-identified as the more northern *L. (G.) rostrata* Say.

Limonia (Geranomyia) cinereinotata (Alexander) is a cranefly with black head, "enclosing a silvery triangle," which occurs in northern South America "northward in the Antilles to Puerto Rico and Hispaniola." Previously recorded by Prof. Alexander (*in* Curran 1928–9) as his *Geranomyia domingensis* from Mameyes, it has since been taken at Rio Piedras and on El Yunque.

Limonia (Geranomyia) myersiana Alexander, known only from Cuba and Puerto Rico, was found by Dr. M. D. Leonard on El Yunque (Alexander 1933–363), and by Dr. W. A. Hoffman at El Semil, Villalba.

Limonia (Geranomyia) rufescens, originally described from Puerto Rico by Hermann Loew as an *Aporosa:* "Beschreibung einiger neuen Tipularia terricola" (Linnaea Entomologica, 5: 385–406. 1951. see p. 396, fig. 9–12 of pl. 2), was listed by Herr Roeder, and noted by Dr. Gundlach: "el ejemplar típico era de Puerto Rico. Hasta ahora no se ha encontrado en

otras islas." Not only has this species not been found in other islands, but it has not since been found in Puerto Rico, and Prof. Alexander (1933–363) notes its possible synonymy with Loew's *tibialis*.

Limonia (Geranomyia) subrecisa was described by Prof. Charles P. Alexander (1933–364) from material collected by Dr. M. D. Leonard on Vieques Island, being most similar to his *recisa* of Central America.

Limonia (Geranomyia) tibialis (Loew), "originally described from Brasil, but not known to have a vast range in the neotropics" according to Prof. Alexander (1933–365), was collected by Dr. M. D. Leonard on Vieques Island, and in Puerto Rico was found by Don Julio (1938–95), and by Dr. W. A. Hoffman at Villalba.

Limonia (Geranomyia) virescens (Loew), originally described from St. Thomas, is somewhat doubtfully applied by Prof. Alexander (1933–365) to craneflies from Las Cruces, but later this determination was given definitely to Dr. W. A. Hoffman for material he had found at El Semil, Villalba.

Helius (Helius) albitarsis, described as a *Rhamphidia* from Puerto Rico by Baron C. R. Osten Sacken (1887–184), has since been repeatedly found on El Yunque.

Polymera (Polymera) geniculata, described by Prof. Charles P. Alexander (Insecutor Inscitiae Menstruus, **3**: 106–7. Washington, D. C., 1915), the type from Carolina, Puerto Rico, in crab holes under rocks, has since been "reared by Dr. W. A. Hoffman from a pupa taken February 20, 1927 in an eddy of a rapidly flowing rocky stream at Barranquitas," according to Prof. Alexander (1933–367), and is also listed by Don Julio (1938–95).

Shannonomyia hoffmani, included among the "New or little-known Species of West Indian Tipulidae (Diptera) I" (Jour. Agr. Univ. P. R., **20** (4): 877–882, fig. 4. Río Piedras, January 1937) described by Prof. Charles P. Alexander, was named for the collector. It is a grey cranefly, associated at light on El Yunque with the pale yellow *S. leonardi*.

Shannonomyia leonardi, described by Prof. Charles P. Alexander (1933–368) from material collected on El Yunque by Dr. M. D. Leonard, is a pale yellow cranefly with spotted wings, since listed by Don Julio (1938–95).

Shannonomyia triangularis, described as a *Pilaria* by Prof. Charles P. Alexander (1927–270), the type collected on El Yunque by Dr. W. A. Hoffman, is "known only from Puerto Rico and apparently restricted to the mountainous section of the Luquillo National Forest" according to Dr. Alexander (1933–369). It is listed by Don Julio (1938–95) without specific locality.

Hexatoma (Eriocera) ocellifera, described as an *Eriocera* by Prof.

Charles P. Alexander (1915–104) from a unique type collected by Mr. R. H. Van Zwaluwenburg at Mayagüez, has not since been found anywhere.

Hexatoma (Eriocera) trifasciata, described as an *Eriocera* by Herr Victor von Roeder (1885–338) from a unique type collected by Dr. Gundlach, presumably at or near Mayagüez, has since been found at Las Mesas, near Mayagüez, over a quiet pool in a small stream at an elevation of 900 feet by Mr. A. H. Madden, and on El Yunque by Don Julio García-Díaz, according to Prof. C. P. Alexander as recorded on page 126 in "New or little-known Species of West Indian Tipulidae (Diptera) IV" (Jour. Agr. Univ. P. R., **23** (2): 91–130, pl. 2. Río Piedras, September 7, 1939).

Gnophomyia (Gnophomyia) diazi was described and named by Prof. Charles P. Alexander (1937–184) after Don Julio García-Díaz, who collected the type female on El Yunque, a black cranefly about 5.0 mm. long, June 7, 1935 at light.

Gonomyia (Lipophleps) bicornuta Alexander (1927–276), the type from El Yunque, has since been repeatedly collected there.

Gonomyia (Lipophleps) bifiligera Alexander (1933–372), the type from Las Cruces, Puerto Rico, has since been found at El Semil, Villalba.

Gonomyia (Lipophleps) monacantha, described by Prof. Charles P. Alexander (1937–184) as differing from the cosmopolitan *G. (L.) helophila* Alexander "chiefly in the structure of the male hypopygium, notably of the outer dististyle," the type from Vieques Island, is abundant in Puerto Rico, collections having been made by Prof. James G. Needham and Don Julio García-Díaz at Lares, the Río Blanco and Río Yúnez. Previous records of *G. (L.) helophila* from Vieques Island and Santurce, Puerto Rico by Prof. Alexander (1933–373), and at Coamo by him (*in* Curran 1928–9), are mis-identifications of this local species, and are to be referred to it.

Gonomyia (Lipophleps) orthomera Alexander (1937–185), the type from Río Tanamá, others from Río Cidra, collected by Prof. Needham and Don Julio, is a yellow cranefly, 4.5 mm. long, with thorax variegated by brown.

Gonomyia (Lipophleps) pleuralis (Williston) is a common neotropical cranefly, first collected in Puerto Rico at Aguadilla by Mr. August Busck, and reported by Mr. D. W. Coquillett as an *Atarba* (*Gonomyia*) and since, according to Prof. Alexander (1933–374), found at Coamo and Santurce. It is characterized by a dark brown stigmal area. Don Julio (1938–95) lists it as having been collected by him, but without noting the locality.

Gonomyia (Lipophleps) producta Alexander, originally described from Antigua, was collected on Vieques Island by Dr. M. D. Leonard, according to Prof. Alexander (1933–374).

Gonomyia (Lipophleps) subterminalis Alexander (1927–175), described from a male collected by Dr. W. A. Hoffman on El Yunque, and most

abundant there, has been found at Las Cruces, at an elevation of 1,300 feet, according to Prof. Alexander (1933–374). It is also listed by Don Julio (1938–95).

Teucholabis (Teucholabis) portoricana Alexander (1937–880) was described from a male collected by Dr. W. A. Hoffman at El Semil, Villalba, differing from *T. (T.) myersi* of Cuba and southern Florida chiefly in the structure of the male hypopygium.

Trentepholia (Paramongoma) niveitarsis, described as a *Mongoma* by Prof. Charles P. Alexander in "A Synopsis of Part of the Neo-Tropical Crane-Flies of the Subfamily Limnobidae" (Proc. U. S. National Museum, 44 (1966): 501. Washington, D. C., April 30, 1913), the type from El Yunque, is, so far as known, found only in the Luquillo Mountains. Prof. Alexander (1933–375) identifies a single broken male from the Blue Mountains of Jamica as "what appears surely to represent this same species."

Polymeda (Mesocyphona) caloptera (Say) is a widely-distributed cranefly of the eastern United States, of which specimens which have "the white wing spots somewhat more reduced in area," according to Prof. Alexander (1933–377), have been found on El Yunque.

Polymeda (Mesocyphona) portoricensis (Alexander) (1933–377), the type from El Yunque, others from Las Cruces, is known only from Puerto Rico. It is listed by Don Julio (1938–95), as an *Erioptera.*

Toxorhina (Toxorhina) fragilis, originally described by Herr Hermann Loew (1851–401) from a type female collected in Puerto Rico by Moritz, is listed by Herr von Roeder and by Dr. Gundlach, who notes: "El tipo era también de Puerto Rico, donde solamente ha sido observado la especie." Prof. Alexander (1933–378) re-describes what he presumes to be this species from Cuban and Hispaniolan males, none of either sex having been found subsequently in Puerto Rico.

Blephariceridae

Paltostoma argyrocincta Curran (1927–1), "opaque black or brown, with silvery white areas apparent from different views, length about 4.5 mm.; scutellum brown, narrow, shaped like the 'cap' of a broadly opened 'toad-stool;' thorax (and abdomen) without trace of hairs," was described from material collected by Dr. Frank E. Lutz at Río Grande. It has since been collected by Prof. James G. Needham and Don Julio García-Díaz on El Yunque and from the Río Sabana, as noted by Prof. O. A. Johannsen (1938–223).

Psychodidae: Moth Flies

Telmatoscopus albipunctatus (Williston), the common large moth fly of Puerto Rico, has repeatedly been noted here since its original identi-

fication as a *Psychoda* by Dr. J. M. Aldrich in 1922, and as a *Pericoma* by Dr. C. H. Curran in 1930. Its very elongate black maggots are sometimes to be found in enormous numbers in containers of dirty water, wiggling at or near the surface, with adults continually emerging and climbing up the side. The adults have feathery white antennae, white tarsi and spines on the legs, and white spots on the wings, surprisingly beautiful and delicate in contrast with the disgusting habitat of the larvae, which have been reared on a dead cockroach and other insect debris in water, and are commonly found feeding on liquid manure or the slime that accumulates in poorly designed plumbing.

Psychoda alternata Say, as determined by Dr. Alan Stone from specimens intercepted on "palo de mato" (*Adenanthera pavonina*) in Bayamón, is not an indoor species.

Psychoda severini listed by Dr. Stahl as *Psychoda phalaenoides* L., is a smaller, less decorative species, of which one or two adults are often noted lurking about the drain of a wash basin.

Maurina hirta, described by Prof. O. A. Johannsen (1938–224) from larvae, pupae and adults collected by Prof. James G. Needham and Don Julio García-Díaz at the Río Guaynabo and Río Yúnez, differs from *Maurina angustipennis* Williston of St. Vincent, which has the wings uniformly covered with black hair, in that its wings are hairless, "basal sections of R_3 and M_2 obliterated."

Of **Phlebotomus cayennensis** Floch and Abonnene, G. B. Fairchild and Marshall Hertig described (Annals Ent. Soc. America, **41** (4): 462–4. Columbus, December 1948) the new subspecies **puertoricensis** from material collected in caves and hollow "bucare" trees at Lares in the summer of 1947 by José Romero and H. Trapido, and **viequesensis** from material collected in a tree hole near Laguna Yanuel and the old Spanish fort at Isabel II, Vieques Island, in June 1947 by J. Andrews and H. Trapido.

Tendipedidae (Chironomidae): Midges

Pentaneura marmorata was described by Prof. O. A. Johannsen as one of his "New Species of Nemocera from Puerto Rico" (Jour. Agr. Univ. P. R., **22** (2): 219–225. Río Piedras, May 1938) from material collected by Prof. James G. Needham and Don Julio García-Díaz from the Río Cidra, March 23, 1925. It is a pale yellow midge with white halteres, 2.5 mm. long.

Pentaneura monilis (L.), variety **peleensis** Walley came to light at Tortuguero Lagoon, August 15, 1935, according to Prof. Johannsen (1938–220).

Coelotanypus insulanus was described by Prof. O. A. Johannsen (1938–220) from females taken at the Río Yúnez by Prof. Needham and Don

Julio, August 11, 1935: a yellowish midge with reddish brown thorax, length 2.2 mm.

Coelotanypus concinnus (Coquillett), originally described from Florida, was attracted to light at the Cartagena Lagoon, as identified by Prof. O. A. Johannsen (1938–220).

Cardiocladius obscurus Johannsen was also attracted to light at the Cartagena Lagoon, August 9, 1935, as identified by Prof. Johannsen (1938–220).

Cricotopus aberrans was described by Prof. O. A. Johannsen (1938–220), the type from Río Tamaná, others from Río Yúnez and Río Cagüitas: a small yellow midge, 1.8 mm. long, with abdomen mostly brownish, halteres white.

Cricotopus conformis, described as a *Crictopus* by Dr. C. H. Curran (1928–12), the type from Guane, Cuba, others from Manatí, Puerto Rico, is characterized by having the "tibiae whitish, the apical third or less of the anterior pair blackish; femora blackish, the narrow bases reddish; length 2.75 to 3 mm." This brownish midge was found by Prof. Needham and Don Julio at Lares and on the Ríos Yúnez, Tanamá and Cidra, according to the identifications of Prof. Johannsen (1938–221).

Cricotopus insolitus, described as a *Crictopus* by Dr. C. H. Curran (1928–11), the types from Mayagüez, others from Manatí, has "all the tibiae whitish" and is from 2.0 to 2.25 mm. long. It was collected by Prof. Needham and Don Julio on El Yunque, and on the Ríos Cidra, Yúnez and Tanamá, according to Prof. Johannsen (1938–221).

Corynoneura (Thienemaniella) similis Malloch was taken at light near the Río Cidra and the Río Yúnez by Prof. Needham and Don Julio, as identified by Prof. Johannsen (1938–221).

Pseudochironomus fulviventris Johannsen was taken at light at El Yunque and on the Río Yúnez by Prof. Needham and Don Julio, according to the identifications given by Prof. Johannsen (1938–221).

Tendipes (Stenochironomus) furcata was described by Prof. O. A. Johannsen (1938–221) from material collected on El Yunque, characterized by the "lack of wing bars, combined with the peculiar furcate dististyles."

Tendipes anonymus, originally described from St. Vincent by Prof. S. W. Williston as a *Chironomus,* is recorded by Mr. W. V. Tower (1912-6) as having been reared from water in old pail, at Mayagüez.

Tendipes bulbosa (Garry), originally described as a *Chironomus* from Cuba, was collected from Guánica, Cartagena and Tortuguero Lagoons, and from the Río Yúnez by Prof. Needham and Don Julio according to Prof. Johannsen (1938–222).

Tendipes redeuns (Walker), reported by Mr. D. W. Coquillett (1900–

250) as a *Chironomus* collected by Mr. August Busck in Puerto Rico, has not since been found here.

Tanytarsus (Rheotanytarsus) meridionalis, a pale yellow midge with the abdomen somewhat greenish, at least when the insect is alive, was described by Prof. O. A. Johannsen (1938–222) from a great abundance of material collected by Prof. Needham and Don Julio, the type from Río Yúnez, others from Río Cidra, Río Tanamá, Quebrada Jobo, and such widely divergent environments as the Luquillo Mountains and Tortuguero Lagoon.

Heleidae (Ceratopogonidae): Punkies

Culicoides furens (Poey), originally described from Cuba (1853–236), was first recorded from Puerto Rico by Dr. F. M. Root (1922–396) as being "the common sand-fly of the coastal region." In "A Review of the Species of Culicoides of North and Central America and the West Indies" (Amer. Jour. Hygiene, **5** (3): 274–301. Baltimore, 1925), Dr. W. A. Hoffman notes specific localities of collection: Río Piedras and Aguirre, and later wrote: "This species is common everywhere near the sea; reared from larvae at and above tide level in the Condado Lagoon, 1928, and in small pools at Escambrón, 1933. It is a vicious biter," and when the wind is not blowing makes life almost unsupportable along the north coast from the Condado, thru Ocean Park and the region on all sides of Laguna San José, to Boca Cangrejos, Laguna Quiñones, Loíza Aldea and in mangrove swamps near Pt. Picúa, Fajardo and Humacao Playa, to people who are susceptible to its bite. When the wind blows, these minute little flies take shelter close to the ground, and will be noted only by barefooted persons resting on the grass, but as the breeze fades in the late afternoon they venture forth, sometimes flying as high as the second stories of houses. They are small enough to penetrate the mesh of all ordinary mosquito bars, and only the finest muslin will protect helpless babies from their attack. Much of the region where they are most abundant appears to be desirable residential region, but in fact is uninhabitable by persons who are most allergic to their bites. "The Effect of Chloroform on some Insect Bites" (Science, **94** (2429): 66. Lancaster, July 18, 1941) is claimed by Dr. W. A. Hoffman to be most prompt in relieving local annoyance, being most effective if applied promptly, and superior to carbon tetrachloride. It is especially recommended for use against this species of punkie, which is cited as being "common and annoying along the costal plain." The most optimistic persons living in the heavily infested region of north Puerto Rico hope that this plague will be abated as more houses are built, but until the margins of the near-by swamps are eliminated, the influx of

additional people only serves to provide additional hosts to be annoyed. Of all the numerous chemicals tested during World War II to protect soldiers of the U. S. Army against attack by punkies in other swampy areas of the world, the most promising is dimethyl phthalate alone, or mixed 6:2:2 with 2-ethyl-1, 3-hexanediol and indalone (n-butyl mesityl oxide oxalate). The commercial availability of such chemicals is no longer restricted to the armed forces. "Eveready" formula No. 612, manufactured by the National Carbon Company, Inc., of New York, is 1,3 ethyl hexanediol, and "Dimelone," manufactured by Dodge and Olcott Company, is bicyclo-(2,21)-5-heptene-2,3-dicarboxylic acid, dimethyl ester. Both of these compounds show high efficiency against punkies and mosquitoes, both are poorly absorbed by the skin, and both possess an odor not highly objectionable to most people. For efficiency and safety, there is little or no difference between them.

Culicoides borinqueni, described by Drs. Irving Fox and W. A. Hoffman as one of "New Neotropical Biting Sandflies of the Genus Culicoides (Diptera: Ceratopogonidae)" (P. R. Jour. Public Health & Tropical Medicine, **20** (1): 108–11, fig. 5. San Juan, September 1944) found in Puerto Rico, is from a type collected at Palmas Abajo.

Culicoides (Hoffmania) inamollae Fox and Hoffman (1944–110) is described from material collected at Mayagüez by Dr. George S. Tulloch.

Culicoides guttatus (Coquillett) is re-described and illustrated by Dr. Irving Fox from material collected at Camp Tortuguero in his "Notes on Puerto Rican Biting Midges or Culicoides (Diptera: Ceratopogonidae)" (Bulletin Brooklyn Ent. Soc., **44** (1): 29–34, pl. 1, ref. 4. Brooklyn, February 1949.)

Culicoides hoffmani Fox, originally described from Camuto, Trinidad, from a single female, has subsequently been associated with the male by Dr. Fox (1949–29) from material reared from tree-hole débris at Mameyes and Luquillo.

Culicoides loughnani jamaicensis Edwards has male and female associated and re-described by Dr. Fox (1949–32) from material taken in a light-trap at Sabana Seca.

Culicoides trilineatus Fox, originally described from St. Thomas, has male and female associated and re-described by Dr. Fox (1949–30) from material reared from tree-hole débris at Luquillo.

Culicoides phlebotomus (Williston), described originally as a *Ceratopogon* from St. Vincent, was identified by Dr. J. M. Aldrich from specimens collected on the beach at Mameyes, and by Prof. O. A. Johannsen from others on the beach at Pt. Cangrejos. As to the comparative abundance of these species of "las plagas o jején" in Puerto Rico, no estimate is possible. To aid in their more rapid identification, however, Dr. Irving

Fox has published on "The Respiratory Trumpet and Anal Segment of the Pupae of some Species of *Culicoides* (Diptera: Ceratopogonidae)" (P. R. Jour. Public Health & Tropical Medicine, 17 (4): 412–425, pl. 2. San Juan, June 1943), based on material collected and mounted by Dr. W. A. Hoffman, of which illustrations had been made by Dr. F. M. Root.

Helea (Brachypogon) impar, described as a *Ceratopogon* by Prof. O. A. Johannsen from material collected by Prof. James G. Needham and Don Julio García-Díaz on El Yunque, has a black thorax, with the antennae, legs and most of the abdomen yellowish, length 0.8 mm.

Ceratopogon punctipennis Williston and **Ceratopogon sequax** Williston, both originally described from St. Vincent, were listed by Mr. D. W. Coquillett (1900–250) as having been collected in Puerto Rico by Mr. August Busck.

Atrichopogon sp., as identified by Dr. Alan Stone, was intercepted on cactus blossom at Barceloneta.

Forcipomyia eriophora (Williston), as identified by Dr. J. M. Aldrich, was repeatedly noted in Puerto Rico before listed as *Ceratopogon* by Dr. C. H. Curran (1928–11) from Mayagüez and the Dominican Republic. Dr. Richard T. Cotton first saw these flies, black with white markings, "with their mouthparts firmly fixed in tobacco hornworms, feeding voraciously, their bodies so distended with the body juices of the host as to be quite green, and so intent on feeding as to be quite sluggish and not easily disturbed." Tobacco hornworms, the larvae of *Phlegethontius sextus jamaicensis* Butler, appear to be the only caterpillars attacked. Half a dozen or more flies attacking a single hornworm at one time have subsequently been noted by Messrs. E. G. Smyth and Francisco Seín Jr.

Forcipomyia flava (Williston) was identified by Dr. Alan Stone from material collected by Dr. Harry Pratt at Tortuguero Lagoon. *Forcipomyia galapagensis* (Coquillett), *F. erucicida* Knab and *F. crudelis* Knab are in synonymy with this fly, originally described from St. Vincent.

Forcipomyia pergandei (Coquillett) was identified by Prof. O. A. Johannsen from larvae, deeply constricted between segments, with two white balls on most segments sticking up above the general level of the insect, abundant on rotten ñame (*Dioscorea* sp.) at Isabela, and later found on rotten banana corm at Río Piedras. The pupae are formed with the anterior end sticking out of the larval skin.

Forcipomyia propinqua (Williston) was identified by Dr. Alan Stone from material intercepted at Mayagüez by Mr. A. G. Harley: a species originally described as a *Ceratopogon* from St. Vincent.

Forcipomyia raleighi Macfie was identified by Dr. Alan Stone from material collected at Tortuguero Lagoon by Dr. Harry Pratt.

Stilobezzia coquilletti Keiffer was identified by Dr. Alan Stone from specimens intercepted in a grapefruit grove near Arecibo, and in a grapefruit grove near Añasco by Mr. A. G. Harley.

Culicidae: Mosquitoes

Dr. Harry D. Pratt of the U. S. Public Health Service, stationed in Puerto Rico for five years (1941–46), is expecting to publish as complete and definitive a report on the mosquitoes of the Island as the extensive and intensive investigations of many specialists now makes possible. This is to appear in the "Puerto Rican Journal of Public Health and Tropical Medicine" of the School of Tropical Medicine in the near future. In anticipation of this publication, the present treatment of the Culicidae here is merely an outline, in extent not to be considered as an index of the relative or economic importance of the family.

Chaobrus (Sayomyia) brasiliensis (Theobald) was first recorded from Puerto Rico, at Mayagüez by Dr. G. S. Tulloch discussing "The Mosquitoes of Puerto Rico" (Jour. Agr. Univ. P. R., **21** (2): 137–169, fig. 9, ref. 26. Río Piedras, April 1937). "Adults were taken in large numbers from light-trap collections, yet the larvae were encountered in only one instance: in a pool formed by a spring in heavily shaded woods." It is listed by Lane (1942–141).

Chaobrus festivus Dyar & Knab, as identified by Dr. Robert Matheson, was listed by Don Julio García-Díaz (1938–95), having been collected while making his ecological survey of fresh water insects of Puerto Rico.

Dixa (Dixella) hoffmani, described by J. Lane (Sao Paulo) in "Dixinae e Chaoborinae, Revisao das espécies neotrópicas (Diptera, Culicidae)" (Revista de Entomologia, **13** (1–2): 81–148, fig. 7, pl. 4, ref. 20. Río de Janeiro, 1942), was from larvae collected by Dr. W. A. Hoffman at Pueblo Viejo and Barranquitas, of which one female (type) was reared to adult. This is the species previously reported as doubtfully *Dixa clavulus* Williston, but which Dr. F. W. Edwards later told Dr. Hoffman was not that, but quite distinct and new.

Corethrella brakeleyi (Coquillett), originally described as a *Corethra* from New Jersey, is now considered by Dr. Alan Stone and H. R. Dodge to be, in part, what Dr. G. S. Tulloch (1937–153) lists as *C. appendiculata* Grabham from Mayagüez (many records), Maricao and Dorado. "The larva, although small in size, is an effective predator on first and second-stage *Culex* larvae. It is found in many open country habitats having clean water, in crab holes, and (referring to an undescribed species) in large numbers in the leafbases of bromeliads." *Corethrella (Corethrella) tripunctata*, described by J. Lane (1942–120) from a type collected at

Carolina, Puerto Rico, at an elevation of 100 feet by Miss Clara South Ludlow, is *C. brakeleyi* according to Drs. Harry Pratt and Alan Stone.

Corethrella sp. nov. is what Dr. W. A. Hoffman collected from a tree hole near Guayama and reported under the name *Corethrella appendiculata* Grabham, and was found by Dr. Tulloch in the leaf-bases of bromeliads. As reported in his "Ecological Notes on Mosquitoes associated with Bromeliads" (Jour. Agr. Univ. P. R., **22** (4): 499–501. Río Piedras, March 23, 1939), the water there enclosed is a very acid environment for mosquito larvae, "the range of pH value being 3.8 to 6.6."

Corethra punctipennis Say, listed by Herr von Roeder and Dr. Gundlach, does not occur in Puerto Rico according to Dr. W. A. Hoffman.

Wyeomyia sp., listed by Dr. C. R. Twinn (*in* Curran 1928–10), a single damaged female from Adjuntas, was first reported with (incorrect) species identification *mitchellii* from Jamaica (Theobald) by Dr. W. A. Hoffman: reared from larvae in bomeliad on El Yunque, November 4, 1934. Subsequently collected there and in the Maricao Forest by Dr. G. S. Tulloch (1937-141), the small bluish-green adults with conspicuous white markings on the hind legs, sometimes "attack man, but cannot be considered fierce biters." The bright yellow larvae, with slightly flattened bodies "move about with a gliding motion over the debris in the leaf bases of the bromeliad (*Catopsis berteroniana*). The water in which they live is either slightly or distinctly acid, having a hydrogen ion concentration corresponding to a pH ranging between 4.0 and 6.5. The temperature of the water varies between 68° and 81°F., being lower on the higher points such as Mt. Britton in the Luquillo National Forest and higher at such points as Maricao." Drs. A. Earl Pritchard and Harry D. Pratt, in presenting their "List of the Mosquitoes of Puerto Rico" (Public Health Reports, **59** (7): 232–3, ref. 6. Washington, D. C., February 18, 1944) consider that the local records represent "a new species."

Anopheles (Nyssorhynchus) albimanus Wiedemann, the most common vector of malaria in the costal lowlands of Puerto Rico, is characterized by "the black and white spotted wings, a broad white band on the hind tarsus, and black and white banded palpi in the female." It was first listed by Herr von Roeder and Dr. Gundlach, and by Dr. L. O. Howard, H. G. Dyar and Fred. Knab in their monumental work on the "Mosquitoes of North and Central America and the West Indies" (**4**: 524–1064. Washington, D. C., 1917) on page 984. In "A Study of Mosquitoes in San Juan, Porto Rico" (Circ. No. 14, P. R. Agr. Expt. Station, pp. 23. Mayagüez, 1912), Mr. W. V. Tower recorded its abundance "in rain-water barrels." This is hardly the most common environment for the larvae, for Dr. F. M. Root in his "Notes on Mosquitoes and other Blood-sucking Flies from Porto Rico" (Amer. Jour. Hygiene, **2** (4): 394–405, fig. 5. Baltimore,

July 1922) found them "in many different kinds of pools, swamps, irrigation ditches, etc., often unshaded, but usually with some aquatic vegetation, more abundant near the coast and lagoons than a few miles inland. Adults attack man readily in the evening." As a result of his "Malaria Surveys in Porto Rico" (P. R. Health Review, 1 (4): 12–18. San Juan, October 1925), Dr. W. C. Earle was convinced that this species was locally "the most important vector of malaria." Dr. H. W. Kumm, recording "The Geographic Distribution of Malaria-carrying Mosquitoes" (Amer. Jour. Hygiene, Monographic Series No. 10, Baltimore, 1929), listed collections at Salinas, Aguirre, Guayama, Fajardo, Caguas, Río Piedras, Sunoco, Cataño and San Germán, and Dr. W. C. Earle in his further study on "Malaria in Porto Rico" (Amer. Jour. Tropical Medicine, 10 (3): 207–230, ref. 8. Baltimore, 1930) records its distribution "throughout most of the island." Dr. Earle's more recent studies are"Notes on the Life-History of *Anopheles albimanus* and *grabhamii*" (P. R. Jour. Public Health and Tropical Medicine, 7 (3): 381–4. San Juan, December 1931), and a year later in the same Journal (8 (3): 227–242), "Some Observations of Anti-mosquito Screening and Screening Methods." His conclusions on "Malaria in Porto Rico in its Relation to the Cultivation of Sugar Cane" (Southern Medical Journal, 23 (5): 449–452. Birmingham, May 1930) are that it is quite possible to grow sugar-cane under irrigation without increasing the malaria prevalence if adequate drainage is provided, as is shown by "The Relation between Breeding Areas, *Anopheles albimanus* density, and Malaria in Salinas, Puerto Rico" (Southern Medical Journal, 30 (9): 946–950. Birmingham, 1937). Indeed, "it was necessary to bring practically all of this enormous breeding area under control before the mosquito density was definitely reduced. The malaria prevalence was not affected until this mosquito density was brought down and maintained at an extremely low figure." With Dr. H. H. Howard as junior author, Dr. Earle's final contribution to local studies is "The Determination of *Anopheles* Mosquito Prevalence" (Bol. Asn. Medica de P. R., 28: 233–240. San Juan, 1936).

The very extensive collection records of Dr. G. S. Tulloch (1937–152) include at their extremes Cartagena Lagoon and Las Marías. He notes that the larvae "appear to breed with equal ease in brackish and fresh water, as they were taken in water having 950 parts of chlorine per 100,000 parts of water. The adults are active only at night; during the day they remain in hiding and consequently little is known of their diurnal activities." Indeed, it is a "wild" mosquito, "which feeds on humans during twilight or at night and seldom remains inside houses for more than a few hours," according to Drs. Porter A. Stephens and Harry D. Pratt in their report on the first year's "Work with Residual DDT Spray in Puerto Rico"

(Science, **105** (2715): 32–33. Baltimore, January 10, 1947). By spraying the interior of all the houses in Humacao Playa with DDT three times during the year, "there was a progressive decrease in percentage of positive malaria" of the inhabitants from 5.8 percent to 0.91 percent a year later, as compared with little change in the check of Loíza Aldea, a comparable community in which none of the houses was sprayed with DDT. This mosquito has not been found on Mona Island, but Drs. Pritchard and Pratt (1944–233) collected it on Vieques Island, as well as at every military camp in Puerto Rico. They noted in "A Comparison of Light Trap and Animal Bait Trap Anopheline Mosquito Collections in Puerto Rico" (Public Health Reports, **59** (7): 221–232, fig. 7. Washington, D. C., February 18, 1944) that both sexes are attracted to the light trap, and even for the collection of females, the light trap is generally superior, especially during the dark phase of the lunar cycle.

In the "Relation of Plants to Malaria Control in Puerto Rico" (Supplement No. 200 to the Public Health Reports, pp. 38, fig. 10, ref. 11. Washington, D. C., December 1947), Dr. Harry D. Pratt shows how the role of plants, even those growing on dry land, is complicated by rainfall, and how sand bar formation at the mouth of rivers emptying into the ocean affects the breeding of *Anopheles albimanus*. In his "Studies on the Comparative Attractiveness of 25-, 50- and 100-watt Bulbs for Puerto Rican *Anopheles*" (Mosquito News, **4** (1): 17–18. Albany, N. Y., 1944), he showed that "the traps attracted *albimanus* in numbers which were approximately proportional to the wattage of the three bulbs." He also found that the "Influence of the Moon on Light Trap Collections of *Anopheles albimanus* in Puerto Rico" (Journal of the National Malaria Society, **7** (3): 212–220, fig. 6, ref. 8. Baltimore, September 1948) was so marked that "an index of 1 to 5 *albimanus* per light trap per night during the 'bright phase' " was the equivalent of 5 to 20 mosquitoes during the dark phase of the moon.

Intensive studies were initiated (1948–49) and summarily terminated by Dr. John W. H. Rehn, Chief of Party for the Columbia University Malaria Mosquito Field Research Project, as to its host preferences, night resting and feeding, daytime resting, and the possibility of the aestivation of immature stages. These lacunae were apparent when Dr. J. M. Henderson spoke "On the Possibility of Eradicating the Malaria Mosquito in Puerto Rico" (Bol. Asn. Medica de P. R., **39** (3): 89–96. San Juan, March 1947) and proposed "The Eradication of *Anopheles albimanus* in Puerto Rico—An Ecological Discussion" (Mosquito News, **8** (2): 45–49 and **8** (3): 97–101. Albany, N. Y., June and September 1948).

Anopheles (Anopheles) grabhamii Theobald is first recorded from Puerto Rico by Howard, Dyar & Knab (1917–1009). Mr. W. V. Tower (1921–6) notes that its "legs are very long; the last ankle segment is white

and there is a black band next to the claw." This is hardly the most distinguishing characteristic of this yellowish-brown *Anopheles*, but rather "the almost circular black scales on the wings," as pointed out by Dr. Harry D. Pratt. Indeed, due to his studies, it is now possible to be certain of "The Identification of the First Stage Larvae of Puerto Rican *Anopheles*" (Public Health Reports, **58** (47): 1715–7, fig. 1. Washington, D. C., November 19, 1943), *grabhamii* having "subantennal hair with branches on only one side of a slender central shaft." Dr. F. M. Root (1922–395) noted it "throughout the coastal plain, but in smaller numbers than *A. albimanus*; breeding places much more local and difficult to find, all well shaded, with considerable aquatic vegetation." Dr. G. S. Tulloch (1937–153) found it breeding in brackish water, in which may be included his record of *A.* (*A.*) *crucians* (Wiedemann): a single larva in the brackish water of a hoof print near Guánica Lagoon. Dr. W. C. Earle thought "*Anopheles grabhamii* (Theobald) a possible Vector of Malaria" (Bol. Assn. Med. P. R., **28**: 228–232. San Juan, 1936) of minor importance due to its comparative indifference to humans. Drs. Pritchard and Pratt (1944–233) found it on Vieques Island (where it had previously been collected by Dr. W. A. Hoffman), and at all but one of the military camps in Puerto Rico, noting that "because of its more restricted breeding habitats, this species is more local in its distribution."

Anopheles (Anopheles) vestitipennis Dyar & Knab was first reported from Puerto Rico by Dr. Harrison G. Dyar in describing "The Male of *Anopheles vestitipennis* Dyar & Knab (Diptera: Culicidae)" (Insecutor Inscitiae Menstruus, **12** (10): 171. Washington, D. C., 1924), based on collections made by Dr. H. A. Johnson. This is the largest of the Puerto Rican *Anopheles*, according to Dr. Harry D. Pratt. It is generally blacker in color, with black and white wing scales irregularly scattered over the entire wing. The blackish legs have many small whitish dots or bands. Drs. Pritchard and Pratt (1944–230) note the scarcity of males vs. females, and of both sexes vs. those of other Anophelines. The first record of a larva: in a ditch in a cane field at Barceloneta, is by Dr. H. A. Johnson, "Occurrence of *Anopheles vestitipennis* in Porto Rico" (Amer. Jour. Tropical Medicine, 6 (2): 153–5. Baltimore, March 1926). That of all species is included by Dr. W. H. W. Komp in "The Anopheline Mosquitoes of the Caribbean Region" (National Institute of Health Bulletin No. 179, pp. 1–195. Washington, D. C., 1942). Dr. W. C. Earle (1925–12 and 1930–214) found it quite abundant at certain seasons (October to January) along the coast. It has not been found to date on Vieques Island.

Toxorhynchites (Toxorhynchites) portoricensis, described as a *Megarhinus* by Herr Victor von Roeder (1885-337) from material collected by Dr. Gundlach, is restricted in its larval environment to tree-holes, as noted

by Dr. Root (1922–395), and the leaf bases of bromeliads, according to Dr. Tulloch (1937-151). Mr. W. V. Tower in 1927 found larvae in a tin can, and Dr. W. A. Hoffman collected them in a treehole near Guayama, and reared them to adult. Distribution is from sea-level, at Mayagüez, to an elevation of 2,000 feet at Maricao, where Dr. Tulloch (1939–500) made his only collection in a bromeliad.

Uranotaenia cooki Root, originally described from Port-au-Prince, Haiti, where adults were found by Capt. C. C. Cook resting on the under surfaces of jetting ledges of rocks over pools in the intermittent stream back of Rue Turgeau, was first found in Puerto Rico by Capt. T. H. G. Aitken, with Dr. Harry D. Pratt, as noted by the latter in his discussion of "The Genus *Uranotaenia* Lynch Arribalzaga in Puerto Rico" (Annals Ent. Soc. America, **39** (4): 576–84, fig. 9., ref. 14. Columbus, December 1946). This was also reported by Lt. Com. Albert A. Weathersbee in "A Note on the Mosquito Distribution Records of Puerto Rico and of the Virgin Islands" (P. R. Jour. Public Health and Tropical Medicine, **19** (4): 643–5. San Juan, June 1944), who subsequently had found the larvae "in a marsh among a thick growth of *Typha* in eastern Puerto Rico" at Ensenada Honda. They have since been found in water densely shaded by water hyacinth (*Piaropus crassipes*) at Salinas, and at Ponce, Humacao, Loíza and various north coast points. They are characterized by having a golden-brown head.

Uranotaenia lowii Theobald, whose larvae almost always have a black head, was first noted in Puerto Rico by Dr. F. M. Root (1922–397) "in grassy, meadow pools kept filled for some time by frequent rains, as at Río Piedras." Dr. Tulloch (1937–151) found it in "open country situations" from Rincón to Cartagena Lagoon and Guánica. Dr. Pratt (1946–582) notes it as being "one of the commonest mosquitoes in light trap collection in Puerto Rico, 500 to 1000 specimens of both sexes sometimes being collected in a single, overnight catch, especially during the rainy season," at north coast localities and on Vieques Island.

Uranotaenia sapphirina (Osten Sacken), first recorded from Puerto Rico by Dr. F. M. Root (1922–397) as *U. socialis* Theobald, from "a small swampy ditch containing *Spirogyra* in a young cane field near Río Piedras," was found by Dr. Tulloch (1937–151) in small numbers at Cabo Rojo and Mayagüez. According to Dr. Pratt (1946–583), it "occurs over most of Puerto Rico throughout the year" and on Vieques Island.

Orthopodomyia signifera (Coquillett) was collected by Lt. Com. Albert A. Weathersbee (1944–643) in the Caribbean National Forest at an elevation of 2,300 feet.

Psorophora (Janthinosoma) confinnis (Lynch Arribalzaga) was found on Vieques Island by Lt. Com. A. A. Weathersbee (1944–644), and re-

ported from Vieques and from five localities in Puerto Rico by Drs. Pritchard & Pratt (1944–233). Under the name *Psorophora jamaicensis* Theobald, this mosquito was first reported from Puerto Rico by Howard, Dyar & Knab (1917–581) from a collection made at Bayamón in 1899 by Mr. August Busck, and Dr. F. M. Root (1922–399) found "larvae in temporary rain pools at Río Piedras, and in a recently flooded irrigation ditch at Aguirre." Dr. G. S. Tulloch (1937–143) collected them only at Mayagüez, especially along the seacost, noting that "the adults are large and vicious biters."

Psorophora (Janthinosoma) johnstonii (Grabham), originally described from Jamaica, was reported from Culebrita and Ponce, Puerto Rico by Dr. Harry D. Pratt in his description of "The Larva of *Psorophora (Janthinosoma) coffini* Dyar and Knab and a Key to the *Psorophora* Larvae of the United States and the Greater Antilles" (Proc. Ent. Soc. Washington, 48 (8): 209–14, fig. 1, ref. 5. Washington, D. C., November 1, 1946).

Psorophora (Janthinosoma) pygmaea Theobald, first reported from Puerto Rico by Dr. G. S. Tulloch (1937–142): at Mayagüez and at many points on the south coast, is a large, well-marked mosquito which bites human beings during the day as well as at night. "The larvae are large, have inflated air tubes, and prefer to live in temporary fresh water ground pools containing little or no vegetation. They are able to develop in brackish water, for at Lake Guánica they were found in hooftrack pools containing 665 parts of chlorine per 100,000 parts of water." Distribution is by no means confined to the south coast, for Drs. Pritchard and Pratt found this species at Borinquen Field (north of Aguadilla) and at Fort Buchanan (west of San Juan), and Lt. Com. Weathersbee (1944–644) on Vieques Island. Both this and the preceeding species, and also such typical salt marsh mosquitoes as *Aedes taeniorhynchus* and *Aedes sollicitans*, have been noted by Dr. Harry D. Pratt (1947–9) to develop in enormous numbers in the flats of pickleweed (*Batis maritima*) after heavy rainfall. "The eggs of these salt marsh mosquitoes are laid on the damp soil. As the land becomes dry, the embryos develop inside the eggs, and they are ready to hatch with the next rainfall. If the water stands on such places for 4 or 5 days, production of (these four species) may be tremendous."

Mansonia (Mansonia) indubitans Dyar & Shannon was first collected in Puerto Rico by Dr. G. S. Tulloch (1937–146) at Sabana Grande and at Cartagena Lagoon, the larvae "attached to the submerged stems of *Pistia stratiotes*," locally known as "lechuguilla de agua," being reared to adult, described and figured. Drs. Pritchard & Pratt (1944–233) found this species at Tortuguero Lagoon, and at Fort Buchanan. The record of *Taeniorhynchus perturbans* Walker from Puerto Rico, by Dr. L. O. Howard

in his "Notes on the Mosquitoes of the United States" (Bulletin No. 25, new series, Div. Ent., pp. 70. Washington, D. C., 1900), may refer to this species, or to the following.

Mansonia (Mansonia) flaveolus (Coquillett), originally described as a *Taeniorhynchus* from the Island of St. Thomas, the type having been collected by Mr. Aug. Busck, occurs in Puerto Rico, the larvae and pupae having been found at Carolina on the roots of water spoon (*Hydromystria stolonifera*), as reported by Dr. Harry D. Pratt in discussing "*Mansonia indubitans* Dyar & Shannon—a New Mosquito Addition to the United States Fauna" (Journal Kansas Ent. Soc., 18 (4): 121–9, fig. 14, ref. 6. Manhattan, October 1945). The adult female of *flaveolus* is definitely yellowish or golden in color, and has palpi more than half the length of the proboscis. Indeed, to this species should be referred all records of *Mansonia* (*Mansonia*) *titillans* (Walker), as identified by Dr. Alan Stone, which was intercepted at Mayagüez by Mr. A. G. Harley, and reported by Dr. Tulloch (1937–146). It is not rare, having been collected by Drs. Pritchard & Pratt at Laguna Tortuguero, at Gurabo and Carolina, at Borinquen Field (north of Aguadilla), Fort Buchanan (west of San Juan), and also on Vieques Island.

Aedes (Stegomyia) aegypti (Linnaeus), described from the West Indies by Fabricius as *Culex fasciatus*, and thus first listed from Puerto Rico by Herr C. Moritz (1836–377) as the only identified species, and subsequently by Dr. Gundlach, is given in Van Zwaluwenburg's list as *Aedes* (*Stegomyia*) *calopus* Meigen, and when mentioned by Mr. W. V. Tower (1908–38, 1912–6 and 1921–5). This is the yellow fever mosquito, noted by Dr. F. M. Root (1922–397) as "very common in and around houses, everywhere swarming in artificial containers around houses," and ever ready to serve as a vector of the disease if any person or animal infected with yellow fever arrives in the regions where it does not now exist. Dr. C. R. Twinn (*in* Curran 1928–10) records it from Mona Island, and it is still a common species there despite the scarcity of people to bite and of artificial containers of water. Dr. W. A. Hoffman collected it on Vieques Island in December 1937, and Dr. G. S. Tulloch (1937–145) has records from "all parts of the coastal plains of Puerto Rico and in many of the towns high in the mountains. The adults are fierce biters and attack freely and without warning during the day and early in the evening." Apparently adults are little attracted to light traps, for Drs. Pritchard and Pratt found it only at Ponce. Physiologically, this mosquito has been intensively studied by Dr. E. B. McKinley, who described "The Salivary Gland Poison of *Aedes aegyptii*" (Proc. Soc. Expt. Biol. & Medicine, 26 (9): 806–9. New York, June 1929), and Dr. R. Kudo describes in his "Studies on Microsporidia

parasitic in Mosquitoes viii. On a Microsporidian, *Nosema aedis* nov. spec., parasitic in a larva of *Aedes argenteus* (*aegyptii*) of Puerto Rico" (Archiv. Protistenk. 49 (1): 23–28, pl. 2, ref. 47. Jena, January 15, 1930).

Aedes (Finlaya) mediovittatus (Coquillett) is first recorded from Puerto Rico by Mr. W. V. Tower (1908–38 and 1912–6), who collected larvae at Mayagüez in hollow tree trunks, tin cans and bamboo pots. Dr. C. R. Twinn (*in* Curran 1928–10) lists a single female from Naguabo, Drs. Pritchard and Pratt (1944–233) found it only at Carolina, but Dr. W. A. Hoffman reared it from larvae in tree holes and bamboo thickets at Yauco, Guayama, Toa Alta, Sabana Llana and Pueblo Viejo. Dr. G. S. Tulloch (1937–145) adds no new locality records. Lt. Com. Weathersbee (1944–644) records it from Vieques Island.

Aedes (Taeniorhynchus) sollicitans (Walker), the common bronze or golden-brown migrating salt marsh mosquito of the Atlantic coast, was first collected in Puerto Rico by Dr. W. A. Hoffman at San Juan in October 1930, his identification being confirmed by Dr. F. M. Root. Drs. Pritchard and Pratt (1944–233) made light trap collections at Fort Buchanan (west of San Juan), and also on the south coast, where Dr. G. S. Tulloch (1937–143) had found it most abundant: at Guayama, Aguirre and Guánica, larvae occurring in brackish pools adjacent to Guánica Lagoon. Lt. Com. Weathersbee (1944–644) records collecting it on Vieques Island.

Aedes (Taeniorhynchus) taeniorhynchus (Wiedemann), a small black and white salt marsh mosquito, common on both the Pacific and Atlantic coasts of the United States, was re-described as *Culex portoricensis*, the type from Puerto Rico, by Miss C. S. Ludlow (Canadian Entomologist, 39: 386. London, Ontario, 1905). Dr. F. M. Root (1922–397) used the name *Aedes* (*Taeniorhynchus*) *portoricensis* for the larvae, which he found in temporary rain pools near large lagoons at Río Piedras and Aguirre, the adults biting man by day. Dr. W. A. Hoffman made repeated collections at Dorado and San Juan, and Dr. G. S. Tulloch (1937–144) found it at Mayagüez and Guánica, the larvae "in clean, dirty, fresh and brackish pools." Drs. Pritchard and Pratt (1944–233) found it attracted to light traps on Vieques Island, and at Losey Field (south of Juana Díaz), at Tortuguero Lagoon, and at other points on the north coast.

Aedes (Ochlerotatus) tortilis (Theobald) was first collected in Puerto Rico by Dr. G. S. Tulloch (1937–143) at Las Mesas, near Mayagüez, at an elevation of 1,000 feet, and subsequently on Maricao mountain at an elevation of 3,000 feet. Dr. Tulloch's "records for *Aedes nubilus*, *A. condolescens* and *A. scapularis* are based on material which probably was" this species, according to Drs. Pritchard & Pratt (1944–232), who made light trap collections at five widely separated localities in Puerto Rico.

Culex (Micraedes) americanus (Neveu-Lemaire) larvae were found

by Dr. G. S. Tulloch (1937–148 and 1939–500) in the water in the leaf bases of bromeliads, malangas and "rábano cimarrón" (*Dieffenbachia seguine*), with a pH of 3.8 to 6, only at the higher elevations: at Maricao and on El Yunque. He assumes that the adults do not attack warm-blooded animals. It was first reported from Puerto Rico by Mr. W. V. Tower (1908–38 and 1912–6) as *Culex bisulcatus* Coquillett, reared from larvae in an old pail at Mayagüez. In synonymy with *americanus*, according to Dr. Alan Stone and Colonel W. H. W. Komp, is also **Culex antillum-magnorum** Dyar, as determined by Dr. F. M. Root, which Dr. W. A. Hoffman found in the water in bromeliads at Jájome Alto and on El Yunque. Presumably at El Yunque Don Julio García-Diaz (1938–95) collected the material which was determined as this species by Dr. Robert Matheson.

Culex (Melanoconion) atratus Theobald was first recorded from Puerto Rico by Dr. F. M. Root (1922–400), who reared "a single male from a pupa collected in a semipermanent roadside swamp at Martín Peña", and identified other adults reared by Dr. W. A. Hoffman on Monteflores Hill, Santurce, and in cattail swamp and small lake at Sardinera, Dorado. Dr. G. S. Tulloch (1937–148) found larvae at Mayagüez, and Drs. Pritchard and Pratt (1944–233) collected adults at light traps near San Juan, at Laguna Tortuguero, and on the south coast at Losey Field, south of Juana Díaz.

Culex (Culex) bahamensis Dyar & Knab was first collected by Dr. W. A. Hoffman as larvae in the turbid outlet of a small lake at Sardinera, Dorado August 15, 1930, his identification of the adults being confirmed by Dr. F. M. Root. Dr. G. S. Tulloch (1937–149) noted larvae so abundant in brackish water near Salinas that it appeared black, and also found them in hoof-track pools around Guánica Lagoon. In light traps, Drs. Pritchard and Pratt (1944–233) collected adults at Ensenada Honda, and on Vieques Island, where Lt. Com. Weathersbee (1944–644) also found them.

Culex (Melanoconion) erraticus Dyar & Knab was redescribed from Puerto Rico by Dr. F. M. Root (1922–400 to 405, fig. 3) as *Culex (Choerophora) borinqueni*, "the commonest 'wild' Culex in the Porto Rican coastal plain, found breeding in all sorts of ditches, slow streams, pools and marshy places," as at Río Piedras, Martín Peña and Aguirre, but subsequently identified as *Culex inhibitator* Dyar & Knab the specimens collected by Dr. W. A. Hoffman at Dorado. Under the latter name, Dr. G. S. Tulloch (1937–147) records numerous collections from the west coast. Dr. W. V. King and G. H. Bradley in "Notes on *Culex erraticus* and related Species in the United States (Diptera, Culicidae)" (Ann. Ent. Soc. America, **30** (2): 345–57, illus. Columbus, June 1937) indicate the synonymy under which Drs. Pritchard and Pratt (1944–233) record their collections at

light traps at Tortuguero Lagoon, at Fort Buchanan (west of San Juan) and at Losey Field (south of Juana Díaz). Lt. Com. Weathersbee (1944–644) collected this mosquito on Vieques Island.

Culex (Culex) chidesteri Dyar larvae are reported by Dr. H. D. Pratt (1946–581) in a reservoir at Salinas.

Culex (Culex) habilitator Dyar & Knab, first identified from Puerto Rico by Dr. F. M. Root from material collected by Dr. W. A. Hoffman at Dorado in a stagnant ditch, October 1, 1930, was found by Dr. G. A. Tulloch (1937–149) breeding in brackish water at Guánica Lagoon, in brackish pools near the Añasco River and in swampy fresh-water areas in Mayagüez. Lt. Com. Weathersbee (1944–644) and Drs. Pritchard and Pratt (1944–233) record it from Vieques Island, the latter collecting adults by light trap at six points in Puerto Rico.

Culex (Culex) janitor Theobald is "known only from adults collected in the mouths of crab holes" according to Dr. G. S. Tulloch (1937–150), who records collections by himself at Mayagüez and Dorado, and by Dr. W. A. Hoffman at Pueblo Viejo.

Culex (Culex) nigripalpus Theobald, first recorded from Puerto Rico by Mr. W. V. Tower (1912–6) as *Culex similis* Theobald, was found by Dr. F. M. Root (1922–399) as larvae "in small numbers in temporary meadow pools at Río Piedras, and in enormous numbers in a ditch highly polluted with sewage at Fajardo." Dr. Root also identified for Dr. Hoffman material from a small pond at Dorado. It has been intercepted at San Juan and at Mayagüez, Dr. G. S. Tulloch (1937–149) noting that it "is probably the most abundant of all tropical forms of *Culex*," listing many collection records from the western end of the Island. Listed from Vieques Island by Lt. Com. Weathersbee (1944–644) and by Drs. Pritchard & Pratt (1944–233), it was collected by the latter from light traps at six points in Puerto Rico.

Culex (Melanoconion) opisthopus Komp, as reported by Drs. Harry D. Pratt, W. W. Wirth and D. G. Denning in their paper on "The Occurrence of *Culex opisthopus* Komp in Puerto Rico and Florida, with a Description of the Larva (Diptera: Culicidae)" (Proc. Ent. Soc. Washington, 47 (8): 245–51, pl. 2, ref. 3. Washington, D. C., November 1945), is known to occur from Cataño to Ensenada Honda: the larvae in sluggish streams with rank vegetation, or pools alongside in dense shade, and the adults attracted to both horse and light traps. It is the only Puerto Rican *Culex* having the last segment of the hind tarsus entirely white, according to Dr. Pratt.

Culex (Melanoconion) pilosus Dyar & Knab larvae were found at Mayagüez by Dr. G. S. Tulloch (1937–147) in a roadside ditch, resting "on their backs on the bottom of the pool, and when disturbed, exhibiting a peculiar

wiggling motion of the hinder parts of the body which is different from that of any other tropical *Culex* encountered." Adults were taken in light traps at Laguna Tortuguero and at Fort Buchanan (west of San Juan) by Drs. Pritchard & Pratt (1944–233).

Culex (Culex) quinquefasciatus Say, first recorded for Puerto Rico by Dr. Augustin Stahl as *Culex pipiens* L., was listed by Mr. W. V. Tower (1908–38) as *Culex cubensis* Bigot, and under the present name by Howard, Dyar & Knab (1917–237): the specimens collected by Mr. Tower at Mayagüez, those from Guayama by R. A. Pearson, and those from Vieques Island by C. C. Craft. Lt. Com. Weathersbee (1944–644) also found it on Vieques, as did also Dr. W. A. Hoffman in 1937, but the first record from Mona Island is by Prof. J. A. Ramos (1947–55) who found it "extremely abundant and troublesome at Sardinera beach, April 4–7, 1944." In Mr. W. V. Tower's later papers (1912–6 and 1921–5), he calls it "the common house mosquito of the tropics" and gives notes on its habits. As *Culex fatigans* Wiedemann Dr. F. M. Root (1922–399) noted it "common everywhere in the coastal plain, breeding in all sorts of artificial containers and biting man readily in the evening," having collected it at Ponce, Aguirre, Río Piedras and Quebradillas. Dr. C. R. Twinn (*in* Curran 1928–10) found that most of the mosquitoes submitted for his examination from Puerto Rico were "this common household mosquito of the tropics."

Dr. W. A. Hoffman reporting, with R. A. Marín and A. M. B. Burke, on "Filariasis in Porto Rico" (P. R. Journal Public Health & Tropical Medicine, 4 (3): 120–7, map. San Juan, March 1928) found it in all localities examined, but scarcer at the higher altitudes, and for "Insectae Borinquenses" (1936–331) wrote: "apparently well distributed throughout the Island, being encountered at such high altitudes as Maricao and above Aibonito in great numbers. It prefers polluted water and breeds in latrines and septic tanks." Dr. G. S. Tulloch (1937–150) records many collections, and that the larvae "are able to develop in clear water or in water heavily laden with sewage. The adults enter houses in great numbers in search of blood, and from the standpoint of annoyance it is most important. It is probably the only vector of filariasis in Puerto Rico." The collections at light trap reported by Drs. Pritchard & Pratt (1944–233) are from the north coast and the interior of the Island, and from Losey Field on the south coast. The effectiveness of spraying with DDT for its control was shown at the Isabela cotton ginnery, where this was the only mosquito found with the other dead insects on the floor and window-sills, and earlier, when Dr. Harry D. Pratt sprayed the basement of the main building of Experiment Station at Río Piedras, May 20, 1944, full of adults coming from stagnant pools in the dried-up and polluted river nearby.

Culex (Culex) secutor Theobald, re-described as the new species *Culex*

toweri by Dr. Harrison G. Dyar & Fred Knab in their "Descriptions of some American Mosquitoes" (Jour. N. Y. Ent. Soc., **15** (1): 13. New York, March 1907) from Puerto Rico, is reported by its collector, Mr. W. V. Tower (1912–6), as reared from larvae in bamboo pots at Mayagüez, but earlier (1908–38) both under this name and as *Culex salinarius* Coquillett. Dr. W. A. Hoffman collected it at Jájome Alto, June 18, 1930, as determined by Dr. F. M. Root, and Dr. G. S. Tulloch (1937–150) found larvae only in deeply shaded pools in the lowlands: at Mayagüez, and in permanent pools at high altitudes in the Luquillo and Maricao Forests.

Deinocerites cancer Theobald, the crab-hole mosquito of the West Indies, was first reported from Puerto Rico by Dr. F. M. Root (1922–405), who thought it "probably found throughout the coastal plain near the ocean and the lagoons, where crab-holes occur. Adults or larvae were collected at Martín Peña, Río Piedras and Aguirre," and at Dorado by Dr. W. A. Hoffman. Dr. G. S. Tulloch (1937–147) made collections at Mayagüez, and Drs. Pritchard & Pratt (1944–233) at light traps at four points in Puerto Rico as well as on Vieques Island, where Lt. Com. Weathersbee (1944–644) also found it.

Fungivoridae (Mycetophilidae): Fungus Gnats

Fungivora merdigera, described by Messrs. F. Knab and R. H. Van Zwaluwenburg as "A second *Myceptophila* with Dung-Bearing Larva (Diptera: Mycetophilidae)" (Entomological News, **29** (4): 138–142, pl. 1. Philadelphia, April 1918), the type from Aibonito, was subsequently reared from larvae on "pomarrosa" (*Eugenia jambos*) at Mayagüez, and from the type locality on "guamá" (*Inga laurina*) by Dr. Richard T. Cotton. Mycetophilids with "dung-capped larvae are rare," according to Mr. Knab, "the only other known being from the Amazon rain forests."

Fungivora insipiens (Williston), determined as a *Mycetophila* by Dr. Alan Stone, originally described from St. Vincent, was intercepted by Mr. R. G. Oakley resting on *Inga vera* at Jayuya.

Leia mutchleri, described by Dr. C. H. Curran (1928–14) from a type male from Adjuntas, is "black above; wings with two brown fasciae; length 4.25 mm." Specimens intercepted at Añasco have been identified as a species of *Leia*, presumably not this.

Boletina incompleta, described by Dr. C. H. Curran (1928–13) from a type female at Adjuntas, has clear wings, and is "pale rusty yellow, the abdomen mostly black; length 3.5 mm."

Lycoria tritici (Coquillett), as identified by Dr. Alan Stone, was reared from larvae in cachaza in soil around begonia seedlings being grown by Mr. Miguel A. Díaz at Río Piedras. Both sexes were present, for the adults were often in coitu, occurring in large numbers, but the maggots seemed to

cause no injury to the tender plants. This is a common continental gnat, of some economic importance, found in greenhouses and outdoors in tobacco seedbeds, and in wheatfields, the larvae feeding on the roots and mining in the stems.

Lycoria hartii (Johannsen), determined as a *Sciara* by Dr. O. A. Johannsen in 1932, was reared from earth in a can in which larvae of *Diaprepes abbreviatus* larvae were being fed on sprouting corn, at Isabela.

Numerous additional species of *Sciara* (or *Lycoria*) are known to be present in Puerto Rico, but lacking accompanying males, specific identification is impossible. Most annoying are the great numbers of stinking black midges that, at about monthly intervals, are attracted to lights for two or three nights during the winter months in the northwestern corner of the Island. They do not fly as high as the second story of houses, but so many may come to electric lights of one story houses, and die on the food on the dining table that it becomes inedible before it can be removed. These gnats do not bite, and indeed they do not ordinarily get on people, but the odor of only a few is so powerful that when they come in large numbers one can only turn out the light and leave the world to them. All are females and neither Dr. O. A. Johannsen nor Miss Elizabeth G. Fisher could identify them as to species. They are so small as to be able to penetrate the mesh of any ordinary mosquito bar, so that one can not even read in bed after dark at the time when they are abundant.

Another species of *Sciara* (or *Lycoria*) has been reared by Mr. Thos. H. Jones from maggots in a cottony substance secreted by mealybugs on sugar-cane; Mr. A. G. Harley at Mayagüez reared others from chayote (*Sechium edule*), and adults of another species have been repeatedly collected from the leaves of corn plants.

Itonididae (Cecidomyiidae): Gall Midges

Asphondylia rochae Tavares, as determined by Dr. E. Porter Felt, was found by Prof. James G. Needham (1941–3) to be causing galls in the seed pods of *Jussiaea angustifolia*, and to be parasitized by *Rileya megastigma* Ashmead and *Callimome montserrati* Crawford.

Asynapta citrinae was described by Dr. E. Porter Felt: "A New Citrus Cambium Miner from Puerto Rico" (Jour. Dept. Agr. P. R., 16 (2): 117–8. San Juan, July 1922). The yellowish white larvae, 3.0 mm. in length when fully grown, injure grapefruit twigs in a manner similar to the West Indian *Asynapta mangifera* Felt larvae do the small twigs of grafted mango. The adults are 1.75 mm. long, pale yellow in color, with black eyes.

Arthrocnodax constricta was described by Dr. E. Porter Felt (Jour. Ec. Ent., 7 (6): 481. Concord, December 1941) from material "reared from garden beans infested with the common red spider, *Tetranychus bimaculatus*,

and probably predaceous thereupon, by Mr. Thomas H. Jones, June 21, 1913 at Río Piedras." The male is 1.0 mm. long, the female, 1.25 mm.; yellowish or yellowish-brown midges, with antennae as long as the body.

Arthrocnodax macrofila Felt, as determined by Dr. E. Porter Felt, was found on mite-infested cattle feed at Río Piedras, presumably preying upon the mites in the feed, "since that is a somewhat common habit for several species of this genus."

Karschomyia cocci, described by Dr. E. Porter Felt (Canadian Entomologist, 45 (9): 304–5. London, 1931) from material reared by Mr. Thos. H. Jones from the pink mealybug of sugar-cane, *Trionymus sacchari* (Cockerell), collected at Patillas, has repeatedly been reared from this host, and Mr. E. G. Smyth (192)–124) reared what he thought to be this species from another mealybug, *Pseudococcus virgatus* (Cockerell), on cotton. "The adults display the strange habit of hanging in rows festooned on strands of spider-web, where they perform a rocking motion by means of the wings," according to Mr. Smyth's observations.

Mycodiplosis insularis was described by Dr. E. Porter Felt (1913–305) from material reared by Mr. Thos. H. Jones from red spiders, *Caligonus antillarum* Banks, on leaves of "molinillo" (*Leonotis neptaefolia*) and of the common milkweed, *Asclepias curassavica.*

Kalodiplosis multifila Felt, first collected in Puerto Rico by Mr. August Busck, according to Dr. Felt, was subsequently identified by him from material reared by Mr. Francisco Seín from *Pseudococcus citri* (Risso) on mulberry.

Dasyneura eugeniae Felt was the tentative identification given by Mr. C. T. Greene of gall midges emerging from a witches' broom formed on a terminal shoot, really a deformed fruit, of crape myrtle (*Lagerstroemia indica*) at Río Piedras.

Itonida coccidarum (Cockerell), originally described as a *Cecidomyia* from Jamaica, was reported by Mr. D. W. Coquillett (1900–240) as found in Puerto Rico by Mr. Aug. Busck: "bred from larvae associated with *Dactylopius citri* and bred from *Lecanium hemisphaericum.*"

Ctenodactylomyia watsoni, described by Dr. E. Porter Felt from midges reared from galls in the leaves of seagrape (*Coccoloba uvifera*) by Prof. J. R. Watson in Florida, is presumably the same insect as that causing the galls of seagrape in Cuba to which Dr. Mel. T. Cook gave the name *Cecidomyia coccolobae.* Typical galls are common on seagrape leaves in Hispaniola and on Mona, the first identification of Puerto Rican material being by Dr. Felt for Mr. R. H. Van Zwaluwenburg at Mayagüez. They occur everywhere in Puerto Rico that seagrape grows, and to a lesser extent inland on some of the other species of *Coccoloba*, but are possibly most abundant at Guajataca, where leaves may be noted with possibly half of the leaf tissue hyper-

trophied by the poisons secreted by the maggots of this midge. From galls at Guajataca, a species of *Eurytoma* (Eurytomidae) and a species of *Telenomus* (Scelionidae), as determined by Mr. A. B. Gahan, have been reared.

Scatopidae

Scatopse pygmaea Loew, a continental March fly, reported also from St. Vincent, was found in Puerto Rico by Mr. Aug. Busck, as listed by Mr. D. W. Coquillett (1900–250). Dr. Wetmore reports one of these flies eaten by a hummingbird.

Bibionidae: March flies

Dilophus spinipes Say, as identified by Dr. Alan Stone, is another continental species found in Puerto Rico, adults having been found resting on the flowers of *Inga laurina* at Cayey. Dr. Wetmore reports a fly of this genus eaten by a hummingbird. Numerous individuals identified by Dr. Alan Stone as a species of *Dilophus* not *spinipes*, were found on flowers of "botoncillo" (*Borreria verticillata*) at Guajataca.

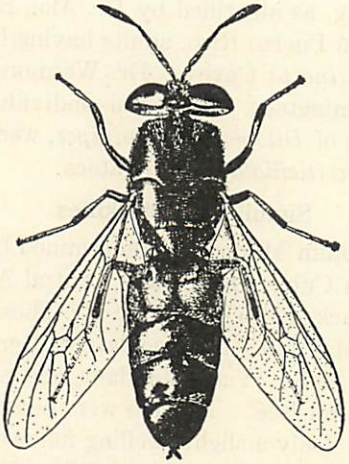
Simuliidae: Blackflies

Simulium haematopotum Malloch, as determined by Mr. J. R. Malloch, previously known from Cuba, Mexico and Central America, was first collected in the low hills back of Río Piedras by Mr. Thos. H. Jones. He noted that "their bite is painful and felt immediately after the fly lights on any exposed portion of the body. Very abundant, and writer was attacked on hands, forearms, neck and face. The flies were persistent, despite a bright sun and slight breeze. Only a slight swelling followed their bites," but he failed to note the small central spot of blood differentiating the lesion resulting from its attack from that caused by punkies. This record was listed by Drs. Harrison G. Dyar and Raymond C. Shannon in "The North American Two-winged Flies of the Family Simuliidae" (Proc. U. S. National Museum, 69 (10): 1–54. Washington, D. C., 1927), but the most extensive account is that by Mr. Schuyler Bradt, working under the direction of Dr. W. A. Hoffman, in his "Notes on Porto Rican Blackflies" (P. R. Journal Public Health and Tropical Medicine, 8 (1): 69–81, fig. 5. San Juan, September 1932). He found that the larvae prefer to attach themselves to vegetation in sluggish streams, and suggests cleaning the streams of vegetation and increasing the rapidity of their rate of flow to make conditions less favorable for their development. He saw them catch and devour mayfly nymphs, and be devoured in turn by the nymphs of dragon flies.

Simulium minusculum Lutz, as identified by Dr. J. M. Aldrich, "described from Brasil, also found in Costa Rica," was found by Mr. Francisco Seín to be abundant only in the spring around Río Piedras.

Simulium quadrivittatum Loew, originally described from Cuba, was first reported from Puerto Rico by Mr. J. R. Malloch in his paper on

"American Black Flies or Buffalo Gnats" (U. S. Dept. Agr., Bureau of Entomology Technical Series No. 26, pp. 83, pl. 6, ref. 26. Washington, D. C., April 6, 1914), on page 61, where collection at Utuado by C. W. Richmond is cited. Dr. Alex. Wetmore notes this blackfly eaten by the tody, and Dr. F. M. Root (1922–396) records his personal reactions to its bite. Presumably this is the more common species in Puerto Rico, being generally called locally "los majes," found usually in the more forested areas, in clearings in the woods, and specifically collected at Río Piedras, Bayamón, Cidra, Corozal, Utuado, Lares and San Sebastián.



The Stratiomyid fly, *Hermetia illucens* (Linnaeus), three times natural size. (Drawn by Fritz Maximilien.)

Stratiomyidae: Soldier flies

Hermetia illucens, described by Linnaeus as a *Musca* from South America, and recorded by Fabricius from the West Indies, has an extended distribution in the neotropics and in the United States as far north as Philadelphia. It is a large black, clear-winged fly, first collected in Puerto Rico by Drs. Stahl and Gundlach and listed by von Roeder. Dr. Gundlach notes: "Se posa muchas veces sobre los troncos de los árboles recién cortados," but less often noted in recent years on recently felled trees, when there are fewer trees to cut down. Sometimes individual flies are attracted to light at night, but normally it is a diurnal fly, not attracted to flowers, and only because it must rest somewhere, coming to rest on any particular wall, leaf, fruit or tree trunk. The larvae are tough, leathery, greyish-brown maggots, flattened and wrinkled at the lateral margins, sometimes to be found in large numbers feeding on decaying vegetation such as moist

paper cartons, well rotted cachaza, rotting grapefruit, or the debris from grapefruit or pineapple canneries. One has been found eaten by the introduced frog, *Rana catesbeiana* Shaw.

Hermetia albitarsis Fabricius, as *Hermetia sexmaculata*, is listed by J. Macquart (Hist. Nat. Dipt., 1:229. Paris, 1834) from Puerto Rico. Dr. C. H. Curran in his "First Supplement to the 'Diptera of Porto Rico and the Virgin Islands'" (American Museum Novitates No. 456, pp. 23, fig. 4. New York, February 11, 1931) states that "the absence of translucent yellowish or whitish spots on the second abdominal segment will at once distinguish this species from *illucens* Linnaeus," and records collection by Prof. W. T. M. Forbes at Las Cruces. Numerous unspotted adults have been taken at Río Piedras, and one at Guajataca. Mr. Policarpo González found numerous maggots in the dry buds of small dead coconut palms (*Cocos nucifera*) at Arroyo, all of which produced the slender, unspotted adults of this species.

Sargus bicolor was described from Puerto Rico by C. R. W. Wiedemann in his "Aussereuropaische Zweiflugelige Insekten," (2: 41. 1830). It was not collected by Drs. Gundlach or Stahl, is not listed by von Roeder, and has not been found since.

Geosargus lucens (Loew), originally described as a *Sargus* from Cuba, was intercepted resting on achiote at Arecibo, as identified by Mr. C. T. Greene.

Macrosargus lateralis (Macquart), originally described as a *Sargus* from Cuba, has been repeatedly intercepted in Puerto Rico, as identified by Mr. C. T. Greene, in grapefruit groves in the metropolitan area, and collected by Mr. S. S. Crossman at Aibonito. This is a slender, iridescent purplish-blue fly of moderate size, its abdomen with whitish pubescent bands.

Neorondania chalybea Wiedemann, originally described from St. Thomas, is a stout blue-black fly, its prothorax striped and its flattened abdomen banded with silvery pubescence, first identified from Puerto Rico by Mr. F. Knab, listed by Mr. R. H. Van Zwaluwenburg (P. R. 1244) from *Spondias lutea*. Adults have repeatedly been noted sucking the juice from overripe jobo fruits on the ground, and from rotting oranges and grapefruit, and Mr. R. G. Oakley intercepted them at Ponce. Dr. Luis F. Martorell noted them in abundance resting on the screens around the kitchen, latrines, and dining room of the camp on Mona Island in 1939. Mr. Thos. H. Jones found the larve "beneath the stinking, flaking bark of dying papaya trees at Río Piedras," and in February 1940, Mr. Anacleto Ramos, gardener of the Experiment Station at Río Piedras, found maggots abundant, feeding on rotten pulp between fibers just under rind of the dead bark of a "yuma" palm, *Cocotrynax argentea*. Another *Neorondania*, not identified as to species by Mr. C. T. Greene, also occurs in Puerto Rico, adults having been

caught in fruit-fly traps, and maggots reared to adult, feeding on rotten banana stem, at Río Piedras.

Eulalia dorsalis (Fabricius), originally described as a *Stratiomys* from the West Indies, presumably St. Thomas, and found also in Santo Domingo, was first reported from Puerto Rico by Mr. D. W. Coquillett (1900–251), having been collected by Mr. August Busck. Dr. C. H. Curran (1928–17) lists specimens from San Juan, and identified for Dr. Stuart T. Danforth many which had been collected at Tortuguero Lagoon, Cartagena Lagoon, and at Mayagüez. Other specimens of an *Odontomyia*, intercepted at Arecibo, have been identified by Mr. C. T. Greene as "near *trivittata*."

Eulalia virgo (Wiedemann) a continental species originally described as a *Stratiomys* from Savannah, Georgia, and later collected at Trenton Falls, New York, was identified by Mr. C. T. Greene from adults found resting on a grapefruit leaf at Barceloneta.

Neurota bicolor (Wiedemann), originally described as a *Sargus* (1830–41) from Puerto Rico, was re-described by Dr. C. H. Curran (1931–2), from specimens from Vieques Island, noting that "Wiedemann states that the color is golden green, but this applies only when the insect is examined without magnification."

Nemotelus monensis, described by Dr. C. H. Curran (1928–16) from a single female from Mona Island, is "metallic greenish black, the front with yellowish white orbital spots below; length 3.0 mm."

Nothomyia calopus Loew, originally described from Cuba, is recorded by Dr. C. H. Curran (1928–16) from Adjuntas, and specimens identified by him have been taken at Mayagüez and Río Piedras.

Pedicella schwarzi, described by Dr. C. H. Curran (1928–16) from a male at Cayey, is a large fly, 12.0 mm. long, the "thorax bright metallic green, the abdomen cupreous-bronzed, the sides with greenish reflections."

Cyphomyia lasiophthalma Williston, originally described from St. Vincent, and by Dr. C. H. Curran (1928–17) recorded from St. Croix, and in Puerto Rico from Cayey, also occurs at many other points, and Dr. Stuart T. Danforth had specimens from Desecheo Island.

Microchrysa flaviventris Wiedemann, as identified by Mr. C. T. Greene, has been intercepted at Yauco by Mr. R. G. Oakley.

Microchrysa polita (Linnaeus), a European and North American species, was intercepted in a grapefruit grove at Garrochales, as determined by Mr. C. T. Greene.

Euryneurasoma slossonae Johnson, as determined by Mr. C. T. Greene, has been intercepted at light at San Juan, and a species of *Spyridopa* on mango blossoms at Mayagüez by Mr. A. G. Harley.

Tabanidae: Horseflies

Chrysops variegata (Degeer), as *Chrysops amazonius* was first reported from Puerto Rico by Camillo Rondani (Arch. Zool. Modena, 3: 81. 1863), according to Dr. Joseph C. Bequaert, writing on "The Tabinidae of the Antilles (Dipt.)" (Revista de Entomologia, 11 (1–2): 253–369, fig. 23. Río de Janeiro, June 1940). As *Chrysops costatus* F., it was identified for Drs. Stahl and Gundlach by Herr von Roeder, and thus listed by them. Dr. Gundlach notes it as being "muy común en terrenos bajos, donde suele posarse encima de las orejas de los caballos para chupar la sangre por lo cual es insecto muy molesto," and Dr. F. M. Root (1922–405) calls it "mosca de mangle." Dr. H. L. Van Volkenburg (1932–25, 1933–23 and 1935–24) repeatedly mentions it as a pest attacking domestic animals, and indeed it occurs in sufficient abundance around Cartagena Lagoon that Dr. Stuart T. Danforth (1920–112 and 121) found it an item of food for the barn swallow and the prairie warbler, and being chased by the Bembecid wasp, *Stictia signata*. Indeed these wasps are so bold in their attempts to catch horseflies as to pounce on them when biting a mounted horse, and scaring both horse and rider. Dr. F. M. Root (1922–405) observed this horsefly captured in flight by a dragonfly, *Lepthemis vesiculosa* F. All records of occurrence in Puerto Rico are from coastal localities, the larvae presumably developing in the muddy water of mangrove swamps, but the species has an extensive neotropical distribution, having been originally described from Surinam. Rarely the flies attack man on head or arms, being especially annoying in the Seboruco woods around Laguna San José, and in paths thru the woods back of Río Piedras, and around Isabela Grove at Pt. Salinas, but are not nearly so common at present as twenty or thirty years ago. Dr. Bequaert translates the original description of *variegata* as being a "tawny-yellow tabanid, with cylindrical antennae, the thorax and abdomen with longitudinal brown stripes; the wing streaked with brown."

Lepiselaga crassipes (Fabricius), first reported from Puerto Rico by Dr. H. L. Van Volkenberg in "An Annotated Check List of the Parasites of Animals in Puerto Rico" (Circular No. 22, P. R. Agr. Expt. Station, pp. 1–12, ref. 49. Washington, D. C., January 1939, *also* Proc. Helminthological Soc. Washington, 5 (1): 7–8. Washington, D. C., 1939) as "collected by Luis Enrique Gregory at San Germán, February 1936, also by H. L. Dozier at Lake Guánica, April 1936, det. Alan Stone" is a decidedly rare Tabanid, with no other record from Puerto Rico cited by Dr. Bequaert (1940–285).

Tabanus (Stenotabanus) brunettii Bequaert (1940–319) of Cuba and Hispaniola, is known from Puerto Rico from a single specimen intercepted by Mr. R. G. Oakley at the Bartolomé finca in the mountains above Yauco, previously recorded as *Stenotabanus punctipennis* Brunetti— det. Dr. Alan

Stone. "In life the eye of the female is purplish-black with two narrow bluish-green cross-bands," according to Dr. Bequaert, who quotes in full the description of *Silvius punctipennis*.

Tabanus (Stenotabanus) caribaeorum Bequaert (1940–323), "medium-sized, light yellow, uniformly white pollinose, without markings; antennae pale yellowish with black annuli; legs pale yellow. Wings hyaline, distinctly spotted at cross-veins; length of female 9–12 mm., of male 10–11.5 mm.," occurs in the Cayman Islands and the Bahamas, and also on Mona Island, paratypes having been collected there by Dr. Luis F. Martorell.

Tabanus (Stenotabanus) nervosus, described by Dr. C. H. Curran (1931–4) from Cataño and San Juan, and not known to occur outside of Puerto Rico, but with subsequent records from Pt. Cangrejos, Dorado and Mayagüez, is "related to *T. psammophilus*, but readily recognized by the peculiar spots of the wings, the shape of the frons and the color of the antennae" (yellowish-red), according to Dr. Bequaert (1940–327). In "Insectae Portoricensis" (1923–214) it is listed as *Tabanus psamophilus* O.S.—det. C. T. Greene, with the note "on the beach, resting on dry seaweed, as which it is the same color, and in which its larvae live, feeding on sand fleas, at Pt. Cangrejos and at Vega Baja." Its most outstanding characteristic is the white pollinosity of its body making it almost indistinguishable when resting on dry seaweed.

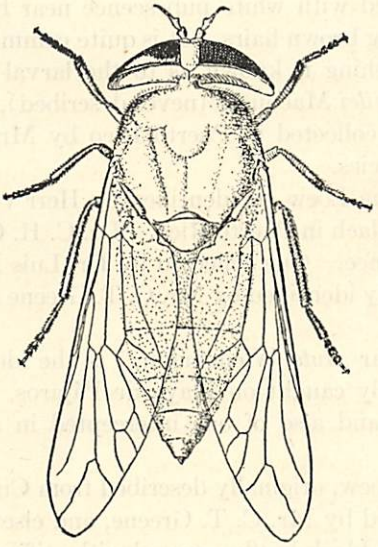
Tabanus (Stenotabanus) parvulus Williston, originally described from Santo Domingo, is known from Puerto Rico from a single female collected by Dr. W. A. Hoffman at Jájome Alto, as listed by Dr. C. H. Curran (1931–6), others noted by Dr. Bequaert (1940–343) having been collected by Dr. Stuart T. Danforth of Gonave Island, Haiti.

Tabanus (Stenotabanus) stigma Fabricius, originally described from St. Thomas, and also known from Antigua, was first recorded from Puerto Rico by Dr. C. H. Curran (1931–4): from Cataño, Dorado and Guayama, a greyish Tabanid, "the abdomen bears distinct, interrupted brownish fasciae on at least several of the segments." Dr. Bequaert (1940–332) records collections at Joyuda (Mayagüez) and Cidra.

Tabanus (Neotabanus) hookeri, described by Mr. F. Knab, from material collected by Dr. C. W. Hooker at Mayagüez, as one of "Some West Indian Diptera" (Insecutor Inscitiae Menustruus, 3 (4): 48–9. Washington, D. C., 1915) is "a small grayish-yellow species," according to Dr. C. H. Curran (1931–6), "the abdomen mostly reddish with three more or less distinct rows of pale spots. It is easily recognized by its small size (10 to 11.5 mm.) and the bare, shining reddish subcallus." He examined specimens collected on Vieques Island by Drs. M. T. Leonard and W. T. M. Forbes, but it is a common species in the coastal areas of Puerto Rico, others having been identified by Dr. Bequaert (1940–361) from Río Piedras, Pt. Cangrejos,

Garrochales and Cartagena Lagoon. It is considered by him as probably occurring all over South America, as well as in Barbados, Trinidad and all of the Greater Antilles.

Tabanus (Neotabanus) truquii Bellardi, according to Dr. Bequaert (1940–352), is known from Puerto Rico only from a single female intercepted at San Juan by Mr. A. S. Mills. It also occurs in Trinidad, the Cayman Islands, the Galapagos Islands, Colombia and in Central America north to the southern United States.



The Tabanid fly, *Tabanus* (*Neotabanus*) *hookeri* Knab, five times natural size. (Drawn by Fritz Maximilien.)

Rhagionidae (Leptidae): Snipe flies

Chrysopilus cubensis, described by Dr. C. H. Curran as one of "New Species of *Chrysopilus* from the Neotropical Region (Rhagionidae, Diptera)" (American Museum Novitates No. 462, p. 9. New York, March 17, 1931), also occurs in Puerto Rico, according to the identification by Dr. M. D. Leonard of a single male collected at Aibonito by Mr. S. S. Crossman, April 23, 1913.

Chrysopilus leonardi, described by Dr. C. H. Curran (1931–4) from a female collected by Dr. M. D. Leonard on Vieques Island, also occurs in Puerto Rico according to the identification of a female from Pt. Cangrejos, June 10, 1920.

Chrysopilus macularis Curran (1931–6) was described from a single female from El Yunque collected by Dr. M. D. Leonard.

Bombyliidae: Beeflies

Hyperalonia cerberus (Fabricius), described as an *Anthrax* from the West Indies, was first listed from Puerto Rico by Herr von Roeder, who identified the specimens which Dr. Gundlach found "muy común en terrenos desmontados." Dr. C. H. Curran (1928–19) lists it from Mona Island, as well as at many points in Puerto Rico, and (1931–7) from Vieques Island. It is a large fly, five-eighths of an inch long, and with a wing spread of almost an inch and a half, the wings mostly chocolate brown, with some clear areas, the abdomen banded with white pubescence near base and near tip, the thorax with stiff, long brown hairs. It is quite common in the coastal areas of the Island. Nothing is known as to the larval habits of this beefly. As *Exoprosopa serveillei* Macquart (never described), Mr. D. W. Coquillett (1900–251) lists as collected in Puerto Rico by Mr. Aug. Busck what is presumably this species.

Exoprosopa cubana Loew, as identified by Herr von Roeder, was found "rara" by Dr. Gundlach in Puerto Rico. Dr. C. H. Curran (1928–19) lists a specimen from Ponce. One collected by Dr. Luis F. Martorell on Mona Island was doubtfully identified by Mr. C. T. Greene as being a species near *E. dodrans* O. S.

Spogostylum "near *pluto* Wiedemann," is the identification by Mr. C. T. Greene of a beefly caught on Playa de Pájaros, Mona Island, by Dr. Luis F. Martorell, and also of one intercepted in a grapefruit grove at Arecibo.

Anthrax adusta Loew, originally described from Cuba, has been found at Guánica, as identified by Mr. C. T. Greene, and elsewhere in Puerto Rico. It is a medium-sized black beefly covered with stiff yellow-brown hairs, its wings yellowish near base.

Anthrax bigradata Loew, originally described from Cuba, was collected in Puerto Rico by Dr. Gundlach, as identified by Herr von Roeder, and listed by them.

Anthrax gideon Fabricius is identified by Dr. C. H. Curran (1928–19) from Ensenada and Mameyes.

Anthrax irroratus Fabricius was the identification by Dr. C. H. Curran of specimens from Utuado and Mayagüez in the AMC collection.

Anthrax oedipus Fabricius was listed from Puerto Rico by Dr. Gundlach.

Villa fauna (Fabricius), first recorded from Puerto Rico as *Anthrax faunus* by von Roeder, identifying specimens collected by Dr. Gundlach, is possibly most abundant in southwestern Puerto Rico, as Dr. Stuart T. Danforth had numerous specimens, as identified by Dr. Curran, from Coamo, Ponce and Mayagüez.

Villa gorgon (Fabricius), first recorded from Puerto Rico as *Anthrax*

gorgon by von Roeder and Dr. Gundlach, was also collected by Mr. Aug. Busck, as noted by Mr. D. W. Coquillett (1900–251), and indeed is possibly the most common local beefly. Dr. C. H. Curran (1928–21) records collections from all parts of coastal Puerto Rico, and Desecheo and Mona Islands, and (1931–8) from Vieques Island. Comparatively small, yellowish-brown, with spotted wings, its appearance by no means suggests its horrid specific name, altho it does indeed mean death to the grubs of the Scoliid wasp, *Elis haemorrhoidalis* (F.), parasitic on the third instar grubs of *Clemora* (or *Phytalus*) *apicalis*. On February 24th, 1922, the sandy field just beyond the bridge over the Bayamón River at Palo Seco was found recently plowed, exposing Scoliid cocoons from two of which the blunt end was cut off by the horns on the puparium of this fly, and adults emerged which were identified by Mr. C. T. Greene. This is reported in "Insectae Portoricensis" (1923–215) and by Mr. Harold E. Box (1925–334), giving a possible clue to the reason why Scoliid parasites are of so little importance in the control of white grubs in Puerto Rico: because of the abundance of beeflies, even tho the specific local host of but one other Bombyliid is known.

Villa lateralis (Say), found in the eastern United States, Mexico and Jamaica, is listed by Dr. C. H. Curran (1928–20) from many Puerto Rican localities, and the Islands of Mona, St. Thomas and St. John, and (1931–7) from Vieques Island.

Villa lucifer (Fabricius), described originally as *Bibio lucifer* from the West Indies, occurs in Louisiana, California, Mexico and the other Greater Antilles, being specifically recorded from Puerto Rico by von Roeder identifying the collections of Drs. Stahl and Gundlach. This is quite a large beefly, dark brown in color, with cloudy brownish wings, yellowish on the fore margins, which Dr. Gundlach found "común—suele posarse en el suelo." Listed by Van Zwaluwenburg (P. R. 78) from Mayagüez, it has most often been collected at Coamo Springs and at Ponce, Guayanilla, Yauco and Guánica on the south coast, also identified from Cartagena Lagoon by Dr. C. H. Curran, and listed by him (1928–21) from Arecibo. Mr. Harold E. Box (1925–342) records it parasitizing the grubs of the Scoliid wasp, *Campsomeris dorsata* F., and Mr. Walter F. Jepson (1936–21) found the adults of this hyperparasite almost as abundant on the flowers of *Kallstroemia maxima* growing on the side of a canefield near Yauco as the wasps themselves.

Phthiria fasciventris was described by Dr. C. H. Curran (1928–21) from a single male from Coamo Springs: "length 4.0 mm., head blackish; mesonotum opaque brown, humeri yellow; posterior calli and scutellum milky white, abdomen rusty brownish-red; wings hyaline, some of the veins with projecting stumps."

Geron senilis (Fabricius), originally described from the West Indies, but

widely distributed in the United States, and specifically known from St. Vincent and Jamaica, was reported from Puerto Rico by Dr. C. H. Curran (1928–22): Caguas and Ensenada, and identified by him from a single specimen collected by Dr. Luis F. Martorell on Mona Island.

Diplocampta roederi, described by Dr. C. H. Curran (1931–8) from specimens collected by Dr. M. D. Leonard on Vieques Island, others from St. Thomas, and from Ensenada, Puerto Rico, is a very dark beefly, 7.5 to 8.0 mm. long, "wings hyaline, with dark brown pattern" darkening the fore margin. "This species is very similar to *paradoxa* Jaennicke, and was identiqed as that species by von Roeder," and by Dr. Curran himself (1928–20): the specimens from St. Thomas and Ensenada, as a *Villa.*

Heterostylum ferrugineum (Fabricius), originally described as a *Bombylius* from the West Indies, was identified by Mr. F. Knab from Puerto Rico, specimens having been collected at Río Piedras, Mayagüez and Ponce. It is an opalescent dark orange in color, for denuded specimens, but normally densely covered with long orange-yellow pubescence, the eyes and antennae dark, the wings hyaline, yellowish at base and on fore margin. Dr. Luis F. Martorell found a single adult flying inside Viejo Lirio Cave on Mona Island, August 8, 1939.

Therevidae: Stiletto Flies

Psilocephala argentata Bellardi, described originally from Mexico, and found also in St. Vincent, was identified by von Roeder and noted by Dr. Gundlach as "rara" in Puerto Rico.

Psilocephala monensis, described by Dr. C. H. Curran (1926–2) from a single female from Mona Island, has "halteres and legs wholly black; front long and very narrow; fourth posterior cell broadly open; length 7.5 mm."

Psilocephala morata Coquillett, as identified by Mr. C. T. Greene, was intercepted in tomato field at Loíza Aldea.

Psilocephala vexans, described by Dr. C. H. Curran (1926–2), the type from St. Thomas, others from El Yunque, Ensenada, Arecibo and San Juan, and many from Mona Island, has "halteres yellow; tibiae and first tarsal segment yellow with brown apices, the two following tarsal segments with yellowish bases; fourth posterior cell closed slightly before the margin of the wing; length 5 to 8 mm."

Asilidae: Robber Flies

Leptogaster cubensis (Bigot), collected in Puerto Rico by Dr. Gundlach and identified by von Roeder, was reported from Mona Island by Dr. C. H. Curran (1928–22).

Atomosia incisuralis Macquart, originally described from Cuba, is listed by Mr. R. H. Van Zwaluwenburg (P. R. 2708), and has since been repeat-

edly intercepted in Puerto Rico: in grapefruit groves at Bayamón, Añasco and Mayagüez. This is a clear-winged, little black fly, 6.0 mm. long, the fifth abdominal segment much the largest, all narrowly margined with white. Specimens of this genus in the AMC collection were considered by Dr. C. H. Curran to be a new species.

Ommatius marginellus (Fabricius), described as an *Asilus* from the West Indies, and having a wide neotropical distribution, was collected by Dr. Gundlach in Puerto Rico and listed by Van Zwaluwenburg (P. R. 107). It is quite a large black Asilid, the distal portion of the wings being opaquely ribbed, and occurs everywhere in coastal Puerto Rico, Dr. Luis F. Martorell having found it also on Mona Island.

Plesioma species "near *indecora* Loew" is the identification by Mr. C. T. Greene of another Asilid fly collected by Dr. Luis F. Martorell on Mona Island.

Allopogon danforthi was described by Dr. C. H. Curran in "New American Asilidae (Diptera)" (American Museum Novitates No. 806; 1–2. New York, 1935) on p. 8, the type from Puerto Rico, collected by Dr. Stuart T. Danforth.

Saropogon dispar Coquillett, as identified by Mr. C. T. Greene, has been intercepted in Santurce.

Townsendia argyrata was described by Dr. C. H. Curran (1926–1), the type from El Yunque, others from Coamo: "front brown pollinose except on the sides and lower portion; third antennal segment tapering from near base; anterior four tibiae silvery white pruinose; apex of each abdominal segment of the female reddish, length 4.0 mm."

Townsendia minuta Williston, as identified by Mr. C. T. Greene, was intercepted near Ensenada by Mr. R. G. Oakley.

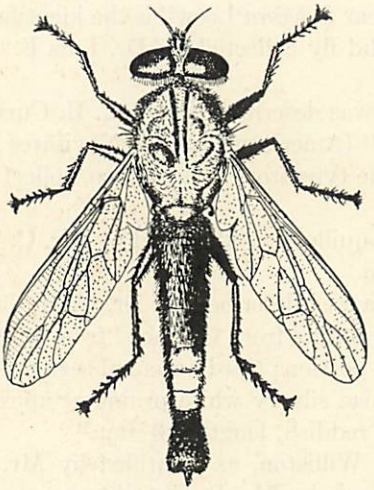
Proctacanthus rufiventris Macquart, originally described from Santo Domingo and Honduras, was identified by von Roeder and listed by Dr. Gundlach from Puerto Rico, but Dr. Stahl used the name *Proctacanthus lutescens* Loew. Mr. Aug. Busck found this, the largest, most powerful and possibly the most abundant of the Asilids of Puerto Rico, as noted by Mr. D. W. Coquillett. Repeated collections have been made since in all parts of the Island: twice noted carrying large grasshoppers, and another carrying a wasp, *Polistes crinitus*, at Aguada. The basal segment of its long, tapering abdomen is the darkest, the next two the brightest yellow-orange, the others darker yellow and narrower, the entire insect being from an inch to an inch and a quarter in length.

Erax bastardi Macquart was the identification by Herr Victor von Roeder of the Asilid fly which Dr. Gundlach listed as *Erax femoratus* Macquart; omitted by Dr. C. H. Curran (1931–9) from his table, "since the record is almost certainly based on a misidentification," altho it would appear that

this older name, based on specimens from Santo Domingo and Guiana, would have priority. *Erax* are large, grey flies, the males having part or all of the fifth to eighth abdominal segments silvery.

Erax forbesi Curran (1931–10) is 17 to 19 mm. long, "abdomen black, the sixth and seventh segments silvery," the type from Coamo Springs. To specimens in the AMC collection, from Coamo, Villalba, Yabucoa, Utuado and Mayagüez, Dr. Curran gave the MS name of *danforthi*.

Erax portoricensis was described by Prof. J. S. Hine (Ann. Ent. Soc. America, 12 (2): 128. Columbus, June 1919) from a single male from Ensenada, which had segments six and seven of the abdomen silvery.



The Asilid fly, *Erax bastardi* Macquart, three times natural size. (Drawn by Fritz Maximilien.)

Erax stylatus (Fabricius), originally described as an *Asilus* from the West Indies, is considered by Dr. Curran (1931–9) probably to be the *Erax rufitibia* Macquart of Haiti, which was Herr Victor von Roeder's identification (1885–339) of what Dr. Gundlach had collected in Puerto Rico, and also that of Mr. F. Knab of what Mr. R. H. Van Zwaluwenburg had found at Mayagüez. Specimens answering to the description in Dr. Curran's key have been taken in flight at Santa Isabel and attracted to light in the Guánica Forest.

Erax tortola Curran (1928–23), originally described from Tortola and St. Thomas, is represented in the AMC collection with specimens from Coamo and Mayagüez, as determined by Dr. Curran.

Dolichopodidae: Long-legged Flies

Chrysotus brevitibia was described by Mr. M. C. Van Duzee from a single male collected at Naguabo by Dr. Frank E. Lutz, one of the "New Dolichopodiae from the West Indies" (American Museum Novitates No. 262, p. 10, New York, March 29, 1927): "palpi whitish; front green; thorax blackish, scutellum green; abdomen very dark green, length 1.6 mm." With the "face of male usually much narrower than the front, the abdomen without strong bristles at apex," according to Dr. C. H. Curran (1928–27), "the members of this genus are among the smallest of the Dolichopodidae and are found on leaves and grass, especially in the vicinity of streams and swamps."

Chrysotus barbatus (Loew), originally described from the Middle West of the United States, but also reported from St. Vincent and Grenada, was listed by Mr. D. W. Coquillett collected in Puerto Rico by Mr. August Busck.

Chrysotus excavatus Van Duzee is listed by Mr. M. C. Van Duzee (*in* Curran 1928–28) from Aibonito, and has been since intercepted in a grapefruit grove at Arecibo.

Chrysotus flavus Aldrich, originally described from St. Vincent, is listed by Mr. Van Duzee (*in* Curran 1928–28) from Adjuntas.

Chrysotus flavohirtus Van Duzee would appear to be a relatively common species in Puerto Rico, listed by Mr. Van Duzee (*in* Curran 1928–28) from Arecibo, Manatí, Orocovis, Adjuntas and Coamo Springs.

Chrysotus inermis Aldrich, originally described from St. Vincent, and known from Cuba according to Mr. Van Duzee (*in* Curran 1928–28), is represented in Puerto Rico by a specimen from Mayagüez.

Chrysotus longipes was described by Mr. M. C. Van Duzee (1927–1) as being "very much like *inermis* Aldrich, but has the cross-vein at the middle of wing; the cilia of the calypters yellow, not brown as in *inermis*; the wings are not at all yellow and the palpi are all yellow." This is apparently a common species in Puerto Rico, described from eighteen specimens, length 1.8 mm., front of face of male blue, "its sides nearly parallel, green, thickly covered with gray pollen; thorax dark shining green with gray pollen; abdomen bronze-green, its hairs mostly yellow." The AMC collection contains specimens identified by Dr. Curran from Cidra, Mayagüez, Hormigueros and Cartagena Lagoon.

Chrysotus minuticornis was described by Mr. M. C. Van Duzee (1927–3) from a single specimen collected at Naguabo by Dr. Frank E. Lutz.

Chrysotus morrisoni Van Duzee is reported (*in* Curran 1928–29) from five Puerto Rican localities.

Chrysotus picticornis Loew, found in middle western and southern United States, Mexico and St. Vincent and Grenada, is listed by Mr. M. C. Van Duzee (*in* Curran 1928–27) from three Puerto Rican localities. It has been intercepted, swept from weeds at Naguabo, as identified by Dr. J. M. Aldrich.

Diaphorus simplex (Aldrich), originally described as a *Lyroneurus* from St. Vincent, found also in Grenada and Mexico, was listed from Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–29) at Aibonito, Caguas and Mayagüez.

Asyndetus interruptus (Loew), originally described as a *Diaphorus* from Cuba, is listed from San Juan, Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–29).

Asyndetus exiguus, described by Mr. M. C. Van Duzee (1927–4) from four males and two females collected by Mr. A. J. Mutchler on seagrape at Arecibo, "is much like *interruptus* Loew but is smaller (length 2 to 2.5 mm.); it has only delicate hairs on the lower surface of femora; the bristles on upper edge of tibiae are few and weak." The face of the male is "opaque with white pollen; palpi, proboscis and antennae black; thorax green with blue and bronze reflections, dorsum covered with thick white pollen; abdomen green with considerable white pollen."

Kierosoma albicincta Van Duzee, as identified by Mr. C. T. Greene, was found in great abundance resting on the walls of the Presbyterian Hospital in the Condado in March 1945. Described originally (1928–24) from Barro Colorado Island, C. Z., and from Biscayne Bay, Florida, this Dolichopodid fly has not previously been recorded from the West Indies.

Thrypticus fraterculus (Wheeler), described originally as an *Alphantotimus* from Wisconsin, but later found in Mexico, was listed by Mr. M. C. Van Duzee (*in* Curran 1928–30) from Puerto Rico: a single male with green femora from Naguabo.

Thrypticus violaceus Van Duzee, described from a single male collected by Dr. Frank E. Lutz at Arecibo, has the legs wholly pale. It is 1.5 mm. long, "face and front bright violet; dorsum of thorax green, anterior portion and scutellum violet; abdomen bright green with blue reflections; all bristles and hairs yellow." It has since been found at Aibonito and Coamo in Puerto Rico, and collected by Dr. Frank E. Lutz on Mona Island.

Plagioneurus univittatus Loew, originally described from Cuba, and recorded from Hispaniola, Florida and northern States, as well as Brasil and Grenada, is listed from Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–30): a single male from Cayey. Dr. C. H. Curran identified specimens in the AMC collection from Salinas, Cartagena Lagoon, San Germán, Sabana Grande and many from Mayagüez, while interceptions have been made at Añasco, Ciales and Guayama.

Gymnopternus sp. was the identification by Mr. C. T. Greene of a fly intercepted on weeds at Caguas. The only species of this genus recorded from the West Indies is *ruficornis* Aldrich, from St. Vincent.

Paraclius femoratus Aldrich, originally described from Mexico, is listed from Mayagüez, Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–30), having its "posterior femora broadly brown apically."

Paraclius filifer Aldrich, described originally from St. Vincent and known to occur in Grenada and Florida, was collected on Vieques Island by Mr. Aug. Busck as recorded by Mr. D. W. Coquillett.

Pelastoneurus aequalis Van Duzee (1927–5), described from a pair from Adjuntas, Puerto Rico, is most "nearly like *floridanus* Wheeler, but has the hypopygial lamellae longer, and oval; and the last section of fourth vein bent near basal third." These flies are 3.0 mm. long, with "thorax largely dark blue with green reflections; abdomen and scutellum green with coppery reflections."

Pelastoneurus fasciatus was described by Herr Victor von Roeder (1885–340) from material collected by Dr. Gundlach, presumably at Mayagüez, "observando solamente en Puerto Rico."

Mesorhaga albiciliata Aldrich, as identified by Dr. J. M. Aldrich, was taken by Mr. E. G. Smyth in the screen trap in the garden at Hda. Santa Rita, Guánica, June 30, 1914.

Sciapus albiciliatus, described as a *Psilopus* by Mr. M. C. Van Duzee (1927–10), the type from St. Thomas, others from Mona Island and from San Juan, Puerto Rico, is "a rather small, shining species with black or metallic femora, yellow tibiae and halteres; long white hair on lower surface of femora and with the fore tarsi ornamented with little bristles of long hair; length 4.3 mm." Its thorax and scutellum are blue, the abdomen green with coppery reflections.

Sciapus chrysoprasius (Walker), a widely-distributed neotropial Dolichopodid, was collected in Puerto Rico first by Dr. Gundlach and listed as a *Psilopus* by Herr Victor von Roeder. Specimens collected in grapefruit groves near Río Piedras and Vega Alta by Dr. Richard T. Cotton were identified by Dr. J. M. Aldrich as *Psilopus cilipes* Aldrich, as listed in "Insectae Portoricensis" (1923–216), and others have since been intercepted in a grapefruit grove at Añasco. Mr. M. C. Van Duzee (*in* Curran 1928–33) places these species in synonymy, and records collections from Corozal and Naguabo.

Sciapus diffusus (Wiedemann), originally described from Brasil and also found in Mexico, was identified for Dr. Gundlach from Puerto Rico and reported by Herr Victor von Roeder. Dr. Curran identified specimens in the AMC collection from Mayagüez and Ponce as being in the genus *Condylostylus*; repeated interceptions have been made at Mameyes, San Juan,

Manatí and Arecibo, and Mr. M. C. Van Duzee (*in* Curran 1928–32) reports additional collections at Cayey and Adjuntas, and occurrence in Haiti, Jamaica and Cuba.

Sciapus digitatus Van Duzee, occurs in Cuba, Jamaica, Haiti and Dominica, according to its describer (*in* Curran 1928–32), and was found in Puerto Rico at Cayey.

Sciapus dimidiatus (Loew), a widely-distributed neotropical Dolichopodid listed by Dr. Aldrich as *Agonosoma dimidiatum*, was identified as a *Psilopus* by Herr Victor von Roeder for Dr. Gundlach's collection in Puerto Rico.

Sciapus dorsalis (Loew) is listed from Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–32), having been collected at Manatí, Arecibo and Aibonito.

Sciapus flavicornis (Aldrich), originally described as a *Gnamptopsilopus* from St. Vincent, is listed from Puerto Rico by Mr. M. C. Van Duzee (*in* Curran 1928–32), and also from Jamaica.

Sciapus graenicheri (Van Duzee) was first listed from Puerto Rico as *Psilopus caudatus* Wiedemann, as determined by Dr. J. M. Aldrich, in "Insectae Portoricensis" (1923–216), and subsequently noted as forming part of the food of a lizard: *Anolis krugii*. Dr. Stuart T. Danforth noted this fly as being eaten by the P. R. mango (1926–90), using the name *Condylostylus* given by Dr. Curran to specimens he had collected at Yauco, Joyuda, Mayagüez and Río Piedras. Mr. M. C. Van Duzee (*in* Curran 1928–33) lists numerous other localities of collection, the extremes being Tortuguero Lagoon and El Yunque.

Psilopus "near *insularis* Aldrich" was the determination by Mr. C. T. Greene of a Dolichopodid fly collected by Dr. Luis F. Martorell on Mona Island.

Sciapus jucundus (Loew), originally described from Cuba but recorded from many of the West Indies, was collected in Puerto Rico by Dr. Gundlach as identified by Herr Victor von Roeder, and has since been intercepted in a lima bean field at Vega Baja.

Sciapus leonardi Van Duzee, named after its collector, Dr. M. D. Leonard, occurs in the Okefenoke Swamp, Georgia (type locality), but also in Haiti, Dominica and Puerto Rico, according to Mr. M. C. Van Duzee (*in* Curran 1928–32), at Aibonito, Adjuntas and Tortuguero Lagoon.

Sciapus longicornis (Fabricius), described originally as a *Dolichopus* from the West Indies, was listed by Mr. D. W. Coquillett (1900–252) as having been collected in Puerto Rico by Mr. Aug. Busck.

Sciapus melampus (Loew), a Mexican Dolichopodid, has been identified as a *Psilopus* by Mr. C. T. Greene, intercepted on weeds at Mayagüez by Mr. A. G. Harley.

Sciapus mundus (Wiedemann), from Florida and Georgia, was identified by Dr. J. M. Aldrich as *Psilopus ciliatus* Loew, from Corozal, Puerto Rico.

Sciapus nubilipennis (Van Duzee) was described as a *Psilopus* (1927–7): a single male from Adjuntas, 5.5 mm. long, "with wings nearly like those of *infumatus* Aldrich, except that the costa is not ciliated; the middle basitarsus is ciliated below the erect bristles, which are longer than the diameter of the joint," with head, thorax, scutellum and abdomen mostly green.

Sciapus pilosus (Loew) was identified by Herr Victor von Roeder as a *Psilopus* from material collected in Puerto Rico by Dr. Gundlach, formerly known only from Cuba.

Sciapus portoricensis, described as a *Psilopus* by Jean Macquart in his "Histoire Naturelle des Diptéres" (**1**: 450, **2**: 121, Paris, 1934–35), has since been intercepted at Mayagüez and at Loíza.

Sciapus pruinosus Coquillett is listed from Puerto Rico at Aibonito and Adjuntas by Mr. M. C. Van Duzee (*in* Curran 1928–33), and has since been intercepted at Maricao.

Sciapus psittacinus (Loew), a Florida Dolichopodid, was identified from Puerto Rico by Herr Victor von Roeder as a *Psilopus* collected by Dr. Gundlach.

Sciapus spinimanus (Van Duzee), described (1927–6), the type from "Sánchez, P. R.," is presumably not a Puerto Rican species, and indeed it seems quite possible that other records by Mr. Van Duzee given as "Dominica" refer, not to the Island in the Lesser Antilles of that name, but to the Dominican Republic, the eastern portion of the Island of Hispaniola.

Sciapus unicinctus (Van Duzee), described as a *Psilopus* (1927–6) from a pair from Aux Cayes, Haiti, other from St. John (U. S. Virgin Islands), is identified by Dr. C. H. Curran (1931–11) from material collected by Dr. W. A. Hoffman at Dorado, Puerto Rico. It is 5.0 mm. long, "front blue; lower part of face green, both covered with silvery white pollen; thorax blue with green reflections and rather short black bristles; abdomen green with black incisures and coppery reflections."

Empididae: Dance Flies

Phoneustica flavida (Williston), described as a *Drapetis* from St. Vincent, was identified as a *Tachydromia* by Mr. D. W. Coquillett (1900–251) reporting its collection in Puerto Rico by Mr. Aug. Busck. Dr. C. H. Curran (1928–25) reports collections at Mayagüez and Coamo, and later identified as this species those collected by Dr. Stuart T. Danforth at Cartagena Lagoon.

Drapetis gilvipes Loew, originally described from Texas, and reported from St. Vincent as *Drapetis xanthopodus*, occurs in Puerto Rico according to Dr. C. H. Curran (1928–25): a single male from Cayey.

Syneches pusillus Loew, recorded from St. Vincent, occurs in Puerto Rico according to Dr. C. H. Curran (1928–25): a single female from Orocovis.

Hybos electus Melander, of the clear-winged variety named *claripennis* by Dr. C. H. Curran (1928–25) from a male from Adjuntas, was previously known from Cuba and St. Vincent.

Hybos triplex Walker, originally described from Trenton Falls, New York, was listed from Puerto Rico by Mr. D. W. Coquillett (1900–251) as *Euhybos subjectus*, collected by Mr. Aug. Busck.

Hybos spinosus Curran (1928–25), the type a male from Adjuntas, Puerto Rico, 3.0 mm. long and black, differs from *triplex* Walker in "the largely pale anterior legs and different genitalia."

Euhybos spiniger, described by A. L. Melander in "Diptera: Empididae" of Genera Insectorum, fasc. 185:32. Brussels, 1927, the type from Utuado, Puerto Rico, "Dr. Curran thinks," according to Dr. M. D. Leonard, this "may be the same as his *Hybos spinosus*."

Phoridae: Humpbacked Flies

Megaselia aurea (Aldrich), described as a *Phora* from St. Vincent, was collected in Puerto Rico by Mr. Aug. Busck, as noted by Mr. D. W. Coquillett (1900-253).

Megaselia macrochaeta (Malloch) and **Megaselia subflava** (Malloch) are listed by Mr. R. H. Van Zwaluwenburg as *Aphiochaeta*, and as an *Aphiochaeta* Dr. J. M. Aldrich determined the specimens of **Megaselia picta** (Lehmann) which Mr. E. G. Smyth found attracted to "some dead *Belostoma* adults collected two nights ago." As a species of *Megaselia* "very close to *fungicola* (Coquillett)," Mr. C. T. Greene identified the Phorid flies intercepted on a polypore fungus.

Megaselia scalaris (Loew) is a common, cosmopolitan Phorid, described as a *Phora* from Cuba, and early reported from St. Vincent and Grenada and the eastern United States. Dr. G. E. Bohart in his paper on "The Phorid Flies of Guam" (Proc. U. S. National Museum, 96 (3205): 397–416, pl. 5, ref. 8. Washington, D. C., 1947), figures both sexes and re-describes this species, which he found "abundant in all inhabited areas and bred freely in such diverse materials as green cornstalks, rotting coconuts, carrion and human excrement. It was almost impossible to keep it from contaminating our cultures of other flies, and it bred freely in fresh stools under examination for intestinal parasites by the parasitology laboratory." In Puerto Rico it has been intercepted in the rotten silk of sweet corn at Mayagüez, in rotten fruit of *Annona glabra* at Palo Seco, in rotten papaya fruit at Arecibo, in hot pepper fruit at Arroyo, and without host record at Bayamón and Adjuntas. It has been repeatedly reared from dead May

beetles, from dead termites poisoned with Paris green, and from other dead insects. Dr. C. H. Curran (1928-43) reports more than forty specimens collected by Dr. Frank E. Lutz on Mona Island, and occurrence in others of the Greater Antilles.

Dohrniphora venusta (Coquillett), as identified by Mr. C. T. Greene, has been reared from dead termites, *Nasutitermes costalis* Holmgren, killed by Paris green in the comejenera, and from other dead insects, as well as from decaying bean pods at Río Piedras.

Conicera latimana, described by Mr. J. R. Malloch as "A New Species of *Conicera* from Puerto Rico" (Proc. Ent. Soc. Washington, **26** (4): 73. Washington, D. C., April 1924), was from a type from Ciales. Presumably it was this species, identified as *Conicera aldrichii* Brues, which Dr. Alex. Wetmore found eaten by a hummingbird.

Puliciphora borinquensis was described by Dr. Wm. Morton Wheeler as "A New Wingless Fly from Porto Rico" (American Museum of Natural History, Bulletin No. 12, Article 14, pp. 267–71, pl. 34. New York, 1906).

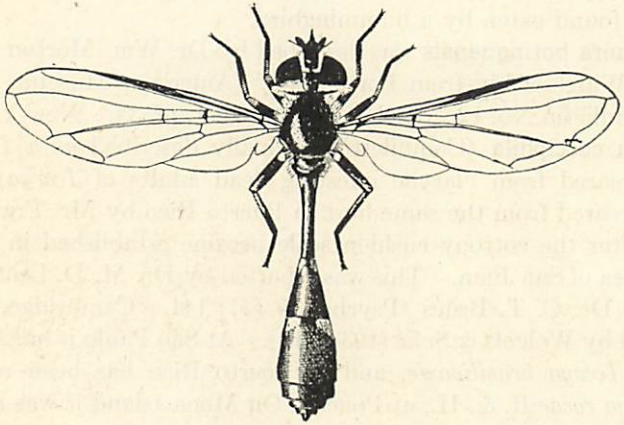
Syneura cocciphila (Coquillett), originally described as a *Phora* from Mexico, reared from "larvae infesting dead adults of *Icerya purchasi*," was first reared from the same host in Puerto Rico by Mr. Francisco Seín shortly after the cottony cushion scale became established in the metropolitan area of San Juan. This was reported by Dr. M. D. Leonard (1932-1106), by Dr. C. T. Brues (Psyche, **39** (4): 141. Cambridge, December 1932) and by Wolcott & Seín (1933-213). At Sao Paulo it has been found infesting *Icerya brasiliensis*, and in Puerto Rico has been reared from *Crypticerya rosae* R. &. H., at Ponce. On Mona Island it was reared from adult cottony cushion scales.

Syrphidae: Flower Flies

Baccha capitata Loew, originally described from Cuba, was first collected in Puerto Rico by Dr. Gundlach and listed by Victor von Roeder, and in Van Zwaluwenburg's list is No. 5035, "on *Aphis* sp." It is a large, yellow and brown fly, with the broadly spatulate abdomen characterizing many of this genus, but decidedly not abundant, adults having been reared from the dull yellow, opalescent puparia at Comerío, Vega Baja and Río Piedras. Mr. Thos. H. Jones noted them associated with hemispherical scales. Dr. M. R. Smith (1942-26) in the coffee region back from Mayagüez found the larvae on coffee twigs not attacked by ants, altho "often observed destroying scales."

Baccha clavata (Fabricius), originally described as a *Syrphus* from the West Indies but since found widely distributed in the United States, Mexico, Brasil and and the Galápagos Islands, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. It was also found

by Mr. Aug. Busck, as listed by Mr. Coquillett, and is given in Van Zwaluwenburg's list as P. R. 88. The adult is a slender, blue-black fly, with two yellowish spots on either side of the spatulate abdomen, the larvae being so common as predators on aphids of all kinds on numerous wild hosts as well as on economic plants, that larva, puparium and adult are figured in "Afidos de Importancia Económica en Puerto Rico" (Circular No. 59, Est. Expt. Insular, Río Piedras, pp. 11, fig. 20. San Juan, September 1922). These flies occur in all parts of Puerto Rico, and are possibly most often noted ovipositing among colonies of aphids, but they also suck exuding sap from corn leaves and have been noted feeding on nectar from coffee flowers.



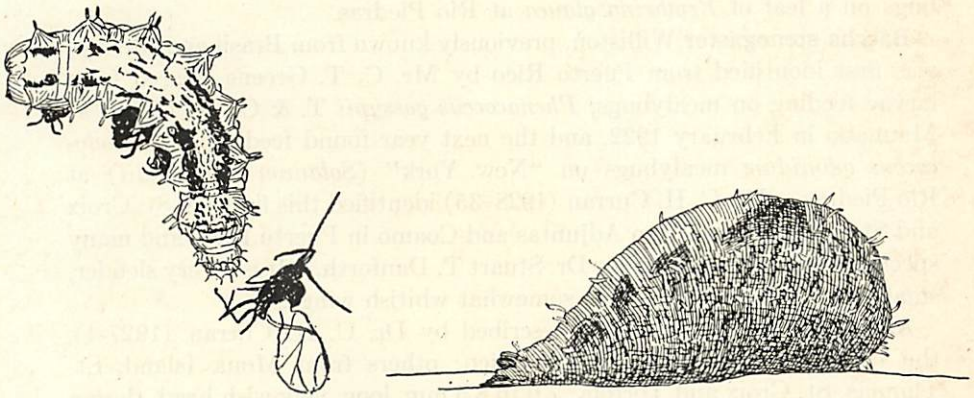
The Syrphid fly, *Baccha clavata* (Fabricius), six times natural size. (Drawn by G. N. Wolcott.)

Baccha (Ocyptamus) conformis Loew, originally described from Cuba, was first collected by Dr. Gundlach in Puerto Rico, presumably at Mayagüez, as listed by von Roeder. In Van Zwaluwenburg's list it is P. R. 1207, and has since been intercepted on mango blossoms at Mayagüez. It is a slender, entirely black Syrphid fly, which Dr. Luis F. Martorell found "flying very low" under trees of "corcho" (*Pisonia albida*) growing along the Carmelita trail on the plateau of Mona Island.

Baccha cylindrica (Fabricius), originally described as a *Syrphus* from the West Indies, is identified by Dr. C. H. Curran (1928-36) from all of the larger Virgin Islands, from El Yunque, Arecibo and Mayagüez in Puerto Rico, and from Mona Island, and in the AMC collection from many more Puerto Rican localities.

Baccha (Ocyptamus) dimidiata (Fabricius), described as a *Syrphus* from the West Indies, and since found in Mexico and the Amazona region of Brasil, is identified by Dr. C. H. Curran (1928-36) from all the larger Virgin Islands, and from El Yunque, Cayey, Aibonito and Mayagüez.

Baccha (Ocyptamus) fasciatus, described from Puerto Rico by Herr Victor von Roeder (1885-342), the type collected by Dr. Gundlach, and noted by him as "observado solamente en Puerto Rico," is large, slender, dark blue, with pictured wings. The larvae have been observed feeding on aphids on coffee leaves at Indiera in the mountains back of Yauco, and on milkweed aphids on the giant milkweed (*Calotropis procera*) at Yauco. Adults have been collected in a cane field at Salinas, and flying among weeds on Mona Island by Dr. Luis F. Martorell.



Larva of *Baccha clavata* (Fabricius), which has just finished feeding on an aphid, and puparium, both about six times natural size. (Drawn by G. N. Wolcott.)

Baccha (Ocyptamus) fuscipennis Say, as determined by Mr. C. T. Greene, has been intercepted at Palo Seco and Dorado.

Baccha gracilis Williston was identified by Dr. C. H. Curran (1928-35) from El Yunque.

Baccha incompta Austen, originally described from Brasil, was identified by Dr. C. H. Curran (1928-36) from Adjuntas.

Baccha (Ocyptamus) latiusculus Loew, originally described from Cuba and recorded from the other Greater Antilles, was collected in Puerto Rico by Dr. Gundlach, as listed by Herr von Roeder, and by Mr. Aug. Busck, as noted by Mr. D. W. Coquillett. Mr. Thos. H. Jones, writing on the "Aphides or Plant-Lice attacking Sugar-Cane in Porto Rico" (Bulletin No. 11, Board of Commissioners of Agriculture P. R., pp. 19, pl. 2. San Juan, 1915), noted the larvae, called a species of *Ocyptamus*, feeding on the yellow aphid of sugar-cane, *Sipha flava* Forbes. They feed on any kind of aphid on any host, even on water lily, and occur in all parts of the Island in great abundance. The adults have a parallel-sided abdomen, bright chestnut in color in life, becoming darker in museum specimens.

Baccha ornatipes was described by Dr. C. H. Curran (1927-3) from a single male from Cayey.

Baccha parvicornis Loew, described originally from Cuba, was first collected in Puerto Rico by Dr. Gundlach, as recorded by Herr von Roeder. It is a large but very slender Syrphid fly, light yellow in color, present in all parts of the Island. Of an adult reared from a puparium on the under side of a coffee leaf covered with fluff from the nymphs of *Ormenis pygmaea*, it may be presumed that the larva had fed on the Fulgorid nymphs. Apparently the maggots are not specific in their choice of hosts however, for others have been found associated with a heavy whitefly infestation on the leaves of *Inga laurina* at Cabo Rojo, and with a heavy infestation of mealybugs on a leaf of *Erythrina glauca* at Río Piedras.

Baccha stenogaster Williston, previously known from Brasil and Mexico, was first identified from Puerto Rico by Mr. C. T. Greene, reared from larvae feeding on mealybugs, *Phenacoccus gossypii* T. & C., on cotton at Maunabo in February 1922, and the next year found feeding on *Pseudococcus adonidum* mealybugs on "New York" (*Solanum wendlandii*) at Río Piedras. Dr. C. H. Curran (1928–35) identified this fly from St. Croix and St. Thomas, and from Adjuntas and Coamo in Puerto Rico, and many specimens from Mayagüez for Dr. Stuart T. Danforth. It is a very slender, small, dark fly, with clear but somewhat whitish wings.

Allograpta fuscisquama was described by Dr. C. H. Curran (1927-4), the type from Ensenada, Puerto Rico; others from Mona Island, St. Thomas, St. Croix and Tortola; 7.0 to 8.5 mm. long, yellowish head, thorax shining greenish black, legs reddish yellow, the abdomen with a complicated pattern in yellow, brown and black. Dr. Curran identified specimens in the AMC collection from Yauco, Villalba, Coamo, Utuado, Río Piedras and Humacao.

Allograpta limbata (Fabricius), originally described as a *Scoeva* from the West Indies, was identified from Puerto Rico by Mr. C. T. Greene: adults reared from larvae and pupae in the arrows or "guajanas" of sugar-cane at Río Piedras and Cidra, presumably feeding on the leafhoppers or leafhopper nymphs of *Nesosteles guajanae* (DeLong). The dark brown, half-moon shaped spot on the bright yellow scutellum is conspicuous, and corresponds with what Dr. Curran describes for his *fuscisquama*—"Scutellum dull yellow with a large, transverse, discal black spot, the pile long and sparse; ventral fringe black, long" so closely, and in other details, as to suggest the synonymy of the two names.

Mesogramma arcifera Loew, originally described from Cuba as *Mesograpta arcifer*, and known also from Jamaica, was first collected in Puerto Rico by Mr. Aug. Busck, as listed by Mr. Coquillett, and in Van Zwaluwenburg's list is P. R. 109. Its black scutellum is outlined apically in yellow, the second segment of the abdomen has two semi-circular yellow marks, those more distad are yellow with obscure brownish markings. Dr. C. H.

Curran (1928-41) lists collections from many points in Puerto Rico, and indeed it is one of the most abundant of Syrphid flies, especially in high malojillo meadows. It has been repeatedly intercepted on mango flowers at Mayagüez, but it has not been reared, and nothing is known of its immature or host relationships.

Mesogramma aurulenta Williston, originally described from Santo Domingo, was identified by Mr. C. T. Greene from a specimen collected by Mr. S. S. Crossman at Aibonito, which has a reddish abdomen except at base. Others are from El Yunque.

Mesogramma basilare (Wiedemann), originally described from Brasil, and known from several of the Lesser Antilles, was identified as *Toxomerus* by Prof. C. L. Metcalf from Puerto Rico: swept from grass at Coloso, Manatí, Caguas and Point Cangrejos.

Mesogramma boscii (Macquart), of the eastern United States and Mexico, was identified as a *Mesograpta* by von Roeder, and listed by Drs. Stahl and Gundlach from Puerto Rico.

Mesogramma duplicata (Wiedemann), a South American Syrphid, is listed by Dr. C. H. Curran (1928-38) from many localities in Puerto Rico.

Mesogramma difficilis, described by Dr. C. H. Curran as one of "New Diptera belonging to the Genus *Mesogramma* Loew (Syrphidae)" (American Museum Novitates Number 405, pp. 14, fig. 3. New York, March 1, 1930) from a single male from Coamo, others from Caguas, Adjuntas, Aibonito, Corozal, and Manatí, is "related to *duplicatus* Wiedemann, having a length of 5.5 to 6.0 mm., face and front yellow, mesonotum greenish black, abdomen orange, with black bands and spots".

Mesogramma floralis (Fabricius) was identified by Dr. C. H. Curran (1928-39) from many localities in Puerto Rico and from the Virgin Islands of St. Thomas and St. John.

Mesogramma laciniosa Loew, originally described from Cuba, was identified for Dr. Gundlach in Puerto Rico by Herr Victor von Roeder, and listed by Mr. C. W. Coquillett as collected by Mr. Aug. Busck. Dr. C. H. Curran (1928-39) notes that he had "seen specimens labeled Porto Rico," and later identified many from Mayagüez and other localities in the AMC collection. It is indeed a very common Syrphid in malojillo meadows and pasture grass and weeds, identified by Prof. C. L. Metcalf as a *Toxomerus*, and thus reported as forming an item in the food of the lizard *Anolis pulchellus*.

Mesogramma minuta (Wiedemann), originally described as a *Syrphus* from Brasil, and reported also from Cuba, is listed by Dr. Gundlach as a *Mesograpta* "rara en Puerto Rico."

Mesogramma musicus (Fabricius) is listed from Puerto Rico by Dr. C. H. Curran (1928-39): a single specimen from Corozal.

Mesogramma picta (Macquart), originally described as a *Syrphus* from Guiana, and known also from Mexico, Cuba and Jamaica, was listed by Dr. C. H. Curran (1928-41) from Puerto Rico: Aibonito and Corozal, and specimens from Añasco and many other localities in the AMC collection were identified by him.

Mesogramma polita (Say), a common continental North American Syrphid fly, reported by C. V. Riley and L. O. Howard in "Insect Life" (1: 5–8. Washington, D. C., July 1888) as "The Corn-Feeding Syrphus Fly," its larvae feeding on pollen and tissues of corn, was first noted in Puerto Rico by Dr. Richard T. Cotton (1918-291), who found the adults "very abundant on corn and some of the native wild grasses. The yellowish colored grubs feed on pollen grains and on the saccharine cells in the axils of the leaves. The grubs pupate between the stalk and the leaf-sheath. Parasitic enemies are numerous." Dr. C. H. Curran (1928-38) notes occurrence in Puerto Rico, and identified specimens in the AMC collection from Mayagüez and many other localities in Puerto Rico. This Syrphid fly was found to be an item in the food of the crested lizard, *Anolis cristatellus*. It has clear wings, light colored thorax and light brownish crescents on several of the segments of a yellowish abdomen.

Mesogramma polygonastyla Metcalf, given this MS name by Prof. C. L. Metcalf "because of the peculiar shape of the styles of the male", was reared from numerous puparia on tobacco plants at Caguas, May 10, 1921. It is presumed that the larvae fed upon other insects which might become stuck to the tobacco leaves.

Mesogramma subannulata Loew, originally described from Cuba and found also in Jamaica and Mexico, was first collected in Puerto Rico by Mr. Aug. Busck, as reported by Mr. D. W. Coquillett (1900-253). Mr. Thos. H. Jones found the larvae feeding on the yellow aphid of sugar-cane, *Sipha flava* Forbes, and Dr. Richard T. Cotton observed females "depositing eggs around colonies of aphis (*Rhopalosiphum persicae* Sulzer) on pepper plants" at Río Piedras. The adults have been swept from grass at Caguas, Ciales and Mayagüez, and are common in at least the more humid sections of the Island.

Mesogramma verticalis, described by Dr. C. H. Curran (1927-6) from a single male at Cayey, has an "abdomen black, with four broadly interrupted yellow fasciae, the last three of which are broadened inwardly; length 5.0 mm."

Mesogramma violacea Curran, originally described from Jamaica, was identified by Dr. C. H. Curran (1928-39) from El Yunque and other localities in the mountains of Puerto Rico, as well as from Arecibo and Mayagüez.

Ornidia obesa (Fabricius), described as a *Syrphus* from the West Indies,

but more generally known as a *Volucella* with a wide distribution in South America, tropical Asia, the Sychelles and Madagascar, is by Dr. C. H. Curran in his "New Species of Volucellinae from America (Syrphidae, Diptera)" (American Museum Novitates Number 413, pp. 23, fig. 1. New York, March 24, 1930) re-established in the genus proposed by St. Fargeau et Serville, having "strong tubercles on the side of the face". This is a large, stout, iridescent green fly, commonly known locally under the name of "mosca cantárida." It was identified by Herr von Roeder for Drs. Stahl and Gundlach, the latter noting it as "sumamente común en los montes." Listed by Van Zwaluwenburg as P. R. 92, it was found by Dr. Stuart T. Danforth (1926-92, 122) to have been eaten by the tody and the northern water thrush at Cartagena Lagoon. Dr. Curran (1928-41) identified it from many localities in Puerto Rico in all parts of the Island, along the coast as well as in the mountains. It typically hovers in a sunny glade, a clearing in the woods or little traveled mountain road, and Mr. Thos. H. Jones collected a plump, grey puparium at the camp on El Duque, above Naguabo, November 4, 1914.

Volucella esuriens (Fabricius), originally described from the West Indies as a *Syrphus*, and since found in the southern United States, Mexico and northern South America, was identified by Herr Victor von Roeder from material collected in Puerto Rico by Dr. Gundlach.

Volucella horvathi Szilady, as determined by Mr. C. T. Greene, is a stout, black and yellow Syrphid fly with pictured wings, found in the Guánica Forest, at Boquerón, and by Dr. Luis F. Martorell on Mona Island.

Volucella pallens Wiedemann, identified for Drs. Stahl and Gundlach as the Cuban *Volucella sexpunctata* Loew by Herr Victor von Roeder, is listed as P. R. 1204 by Mr. R. H. Van Zwaluwenburg. Dr. C. H. Curran (1928-42) noted only specimens from El Yunque, but identified this species from many other Puerto Rican localities as represented in the AMC collection. Its name is most appropriate for it is a distinctly pallid yellow by comparison with more contrastingly marked Syrphids; in Dr. Curran's Key (1930-6) being characterized by "yellowish squamae." It has been repeatedly intercepted on the fruits of orange and grapefruit, and collected by Mr. Thos. H. Jones on flowers of "capá prieto" (*Cordia alliodora*).

Volucella pusilla Macquart, originally described from Cuba, was listed from Puerto Rico by Dr. Gundlach, having been identified by Herr von Roeder.

Volucella tricincta Bigot, as identified by Mr. C. T. Greene, has been intercepted at Mayagüez and Bayamón.

Volucella unipuncta, described by Dr. C. H. Curran (Ann. Ent. Soc. America, **19:** 63, 1926), the type from Desecheo Island and Ensenada,

Puerto Rico, has since been identified by him from Coamo: specimens in the AMC collection.

Eristalis albifrons Wiedemann was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. As *Eristalis albiceps* Macquart, Dr. Alex. Wetmore reports this Syrphid fly as having been eaten by the swallow, martin and redstart. Dr. Curran (1928-12) records it only from El Yunque, but it has been intercepted at Loíza and Pueblo Viejo.

Eristalis atrimanus Loew was first identified from Puerto Rico by Mr. C. T. Greene, from specimens swept from flowers on the beach at Pt. Cangrejos by Dr. Richard T. Cotton, but it had earlier been collected on flowers of "capá prieto" (*Cordia alliodora*) by Mr. Thos. H. Jones, and more recently noted resting on sugar-cane at Yauco. Dr. C. H. Curran (1928-43) records occurrence at Aibonito, and has identified many specimens in the AMC collection from many localities. Its thorax has two silvery bands, its scutellum is yellow and the first abdominal segment has two lateral yellow spots almost as large as the scutellum. When intensive search was being made on flowers of "botoncillo" (*Borreria verticillata*) for *Larra americana* along the north coast of Puerto Rico, this was one of the common Syrphids most often noted, collected at Laguna Tortuguero and Luquillo.

Eristalis cubensis Macquart is listed by Dr. C. H. Curran (1928–43): a single female from Manatí.

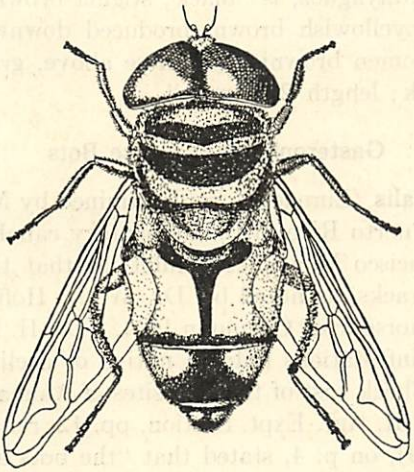
Eristalis hortorum (Fabricius), originally described as a *Syrphus* from the West Indies, and known from St. Thomas and Santo Domingo, was identified by Mr. C. T. Greene from interceptions made at Dorado, Ponce and Mayagüez.

Eristalis pusio Wiedemann, originally described from Brasil, was collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder.

Eristalis vinetorum (Fabricius), originally described as a *Syrphus* from the West Indies and since reported from many neotropical islands and countries, being found as far north as Philadelphia and as far south as Argentina, was identified by Herr Victor von Roeder for Drs. Stahl and Gundlach. In Van Zwaluwenburg's list it is P. R. 96, and Dr. C. H. Curran (1928-42) reports it from many Puerto Rican localities, as well as from the Islands of St. Thomas, St. John and St. Croix. It is one of largest of the local Syrphids, being a much larger and somewhat paler *atrimanus* in appearance, found in the mountains as well as along the coast. Most collections of adults have been made from flowers: those of the yellow caltrop (*Tribulus cistoides*) in Puerta de Tierra early in the morning, and repeatedly from "botoncillo" (*Borreria verticillata*) between 11 AM and 2 PM. Large numbers of rat-tailed maggots found in well-rotted cachaza at Río Piedras

in November 1942 by Mr. Francisco Seín proved to be the immature larval stage of this fly. All of these species of *Eristalis* should be **Tubifera** if the genera of Meigen 1800 are recognized.

Meromacrus cinctus (Drury), described originally as a *Musca* from Jamaica and Santo Domingo, was identified by Herr Victor von Roeder for Puerto Rico from flies collected by Dr. Gundlach. This beautiful large Syrphid, with tufts of bright yellow hair at the base of its wings and behind the head, posteriorly banded across the black thorax, its scutellum and abdomen dull orange, in Van Zwaluwenburg's list is P. R. 616, and in the AMC collection was identified by Dr. C. H. Curran: specimens from Hormigueros, Río Piedras and Jayuya. It rarely occurs along the coast, but was collected by Mr. S. S. Crossman at Aibonito, intercepted at Adjuntas by Mr. R. G. Oakley, and has been repeatedly noted at El Yunque and at El Verde in the Luquillo Mountains.



The Syrphid fly, *Eristalis vinetorum* (Fabricius), four times natural size. (Drawn by Fritz Maximilien.)

Meromacrus pratorum (Fabricius), originally described as a *Syrphus* from the West Indies, was identified from Puerto Rico by Herr Victor von Roeder as collected by Dr. Gundlach, but no recent collection has been made here.

Xylota pachymera Loew, originally described from Cuba, was collected in Puerto Rico by Dr. Gundlach, as determined by Herr Victor von Roeder.

Conopidae: Thick-headed Flies

Conops pictus Fabricius, originally described from the West Indies, was collected in Puerto Rico by Dr. Gundlach, as identified by Victor von

Roeder. It was collected by Messrs R. G. Oakley and A. S. Mills at Isabela, June 26, 1948, as determined by Mr. C. W. Sabrosky. Mr. C. T. Greene identified as a species of *Conops* "near *xanthopareus* Williston" a Conopid fly intercepted at Bayamón.

Physocephala sp. is the determination by Mr. David G. Hall of the yellow and brown wasp-like flies which were found frequenting the flowers of "botoncillo" (*Borreria verticillata*), presumably awaiting opportunity to oviposit on some bee or wasp. A pair has been collected in coitu, resting on a citrus leaf at Isabela, others at Palo Seco, Ceiba and Yabucoa.

Zodion nanellum Loew was collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder.

Dorilaidae (Pipunculidae): Big-headed Flies

Pipunculus regalis, described by Dr. C. H. Curran (1928-43) from a single female from Mayagüez, is "black; stigma brown; antennae black, the third segments yellowish brown, produced downwards into a long, tapering point; abdomen brownish pollinose above, grayish on the sides and base; legs black; length 2.25 mm."

Gasterophilidae: Horse Bots

Gasterophilus nasalis (Linnaeus), as determined by Mr. E. F. Knipling, was first found in Puerto Rico in the alimentary canal of a horse at Río Piedras by Dr. Francisco Menéndez Guillot, at that time official veterinarian for the racetracks, as noted by Dr. W. A. Hoffman, who himself found the bots in a horse from Coamo in 1934. Dr. H. L. Van Volkenberg (1935-23) reported infestations mild in native or acclimated horses, but in "An Annotated Check List of the Parasites of Animals in Puerto Rico" (Circular No. 22, P. R. Agr. Expt. Station, pp. 12, ref. 49. Washington, D. C., January 1939), on p. 4, stated that "the bots are found in about fifty percent of necropsies on the horse, but infestations are mild in character." This confirms Dr. Hoffman's opinion that the horse bot is definitely established in Puerto Rico, and not merely a temporary importation in racehorses from the States.

Hypoderma lineatum (De Villiers), the ox bot or ox warble fly, altho many times found in imported cattle, as first noted by Dr. Gerard Dikmans in the 1925 Report of the Mayagüez Station (1927-23), and repeatedly noted by importers and purchasers of Holstein-Fresian cattle, has not become established in Puerto Rico. This was stated by Dr. H. L. Van Volkenberg (1932-25, 1934-25 & 1935-23) in all his earlier accounts of the insect parasites of cattle in Puerto Rico, but is not mentioned in his Circular No. 22.

Larvaevoridae (Tachinidae): Tachinid Flies

Trichopoda pennipes (Fabricius) was first identified from Puerto Rico by Herr Victor von Roeder as the South American *Trichopoda pyrrhogaster* Wiedemann, and was listed under that name by Van Zwaluwenburg: P. R. 104. This is one of the most attractive and interesting of the Tachinid flies, but one of the least typical. In life the fly holds its posterior legs so that the brush of coarse hairs on the outside of each femora is conspicuous, and its abdomen and relatively enormous squamae are of bright chestnut or dull orange color; the wings dark except on posterior margin, its dark prothorax laterally margined and striped with gold. Mr. Charles E. Wilson, in discussing the "Truck-Crop Insect Pests in the Virgin Islands and Methods of Combating Them", (Virgin Islands Agr. Expt. Station Bulletin No. 4, pp. 35, fig. 24. Washington, D. C., June 21, 1923) noted that "an average of 24.17 percent of adult specimens of *Nezara viridula*, the southern green stink bug, collected at intervals of 14 days throughout the year, were parasitized by *Trichopoda pennipes*. The maximum number parasitized, 93 percent, occurred in January, and the minimum number, 12 percent, occurred in May. The pupal stage of the parasite under laboratory conditions at the station varied from 12 to 16 days. In no case was a parasite reared from nymphs taken in the field, nor were parasitic eggs found on the host in any nymphal stage. Of the various species of Hemiptera collected, only one other species, the stink-bug (*Thyanta perditor*), taken from Lima beans, showed the presence of parasitic eggs." Little wonder that Mr. Wilson considered this Tachinid fly to be the most important natural control for the southern green stink bug in the Virgin Islands, yet in Puerto Rico this fly is by no means abundant, and has been reared from this host only at Isabela. Dr. H. C. Dozier (1926-116) reared this fly from the sweet potato bug (*Corecoris fusca*), but all other records are of collection of adults: on flowers of "botoncillo" (*Borreria verticillata*) at Yabucoa, of coriander (*Coriandrum sativum*) at Isabela, and intercepted at Mayagüez, as determined by Mr. David G. Hall.

Trichopoda flava, described by Victor von Roeder (1885-343) from material collected by Dr. Gundlach in Puerto Rico, is considered by the latter "parece ser propia de la isla."

Trichopoda haitiensis Desvoidy was identified by Dr. C. H. Curran (1928-113) from the Islands of St. Croix and St. Thomas, as well as from Mayagüez, and he gave this name to specimens in the AMC collection from Mayagüez, San Germán, Utuado, Coamo and Río Piedras.

Ectophasiopsis arcuata (Bigot) and *Cylindromyia porteri* (Bréthes), Tachinid flies from Chile, known to be parasitic on Pentatomid bugs, introduced by the Mayagüez Station, as noted in the Report for 1941 (1942-

20), did not survive in Puerto Rico. The first species arrived in poor condition, and the latter, altho active and able to copulate and oviposit in the hosts supplied, did not in fact parasitize any of them.

Hyalomyia chilensis Macquart and *Acaulona peruviana* Townsend, known parasites of the Peruvian cotton stainer, *Dysdercus ruficollis* (L.), were imported by the Mayagüez Station, as noted in the Report for 1942 (1943-15), in the hope that they would parasitize the species of cotton stainer present in Puerto Rico. The first species did not oviposit in nymphs of the local species of *Dysdercus*, and the results of rearing the latter in the laboratory were most meagre. Searching in the field for their released descendents however, Mr. H. K. Plank found a native parasite, which Mr. C. W. Sabrosky (Jour. Washington Academy of Sciences **40** (11): 370. Washington, November 15, 1950) named **Acaulona erythropyga.**

Lydella stabulans var. *grisescens* Rond., an introduced parasite of the larva of the sugar-cane moth-borer, *Diatraea saccharalis*, was not recovered in Puerto Rico, according to the account in the Report of the Mayagüez Station for 1937 (1938-96).

Lydella incompleta Curran, as identified by Dr. J. M. Aldrich, was reared from guava fruits intercepted at Bayamón.

Rhodogyne fuliginosa (Desvoidy), identified as *Gymnosoma filiola* by Herr Victor von Roeder, is listed by Dr. Gundlach from Puerto Rico.

Comyopsis fumata Towsend, as determined by Dr. J. M. Aldrich, was intercepted at Mayagüez.

Acronarista mirabilis Townsend is identified by Dr. C. H. Curran (1928-113) from Puerto Rico: a single female from Orocovis.

Sciasma nebulosa Coquillett is identified by Dr. C. H. Curran (1928-114) from Puerto Rico: specimens from Caguas and Aibonito.

Erycia consistens, as described by Dr. C. H. Curran in his paper of "New West Indian Tachinidae" (American Museum Novitates Number 260, pp. 15, fig. 5. New York, March 19, 1927), on p. 10, from a single male from Coamo, is "related to *celer* Coquillett but the intermediate abdominal segments lack discals and their apices are very broadly shining; length 6.0 mm."

Spathidexia atypica, is described by Dr. C. H. Curran (1927-11) from female flies swept from grass and weeds at Adjuntas, Aibonito and Manatí: "black with whitish pollen, length 4.0 mm."

Spathidexia dunningi (Coquillett) is identified by Dr. C. H. Curran (1928-111) from males from Mayagüez and Manatí.

Clausicellana mitis, as described by Dr. C. H. Curran (1927-12) from a male from Aibonito, is "black with grayish pollen, length 3.0 mm."

Comatacta insularis is described by Dr. C. H. Curran (1927-12) from flies from San Juan and Manatí as being "black, the first two antennal

segments, knees very narrowly, palpi, halteres and obscure areas on the sides of the abdomen reddish; length 5.5 to 6.5 mm."

Prorhynchops errans is described by Dr. C. H. Curran (1927-13) from flies collected by sweeping at Manatí, Arecibo, Caguas and Adjuntas as being "black, with grayish pollen; apical section of proboscis longer than height of head (as illustrated); length 4.5 mm."

Hypostena vanderwulpi (Townsend) originally described as a *Myrothyria* from southern Florida, was collected in Puerto Rico by Mr. Aug. Busck, as reported by Mr. D. W. Coquillett (1900-254).

Tachinophyto floridensis Townsend occurs in Puerto Rico according to Dr. C. H. Curran (1928-111), three females having been collected at Adjuntas.

Plagiprospherysa occidentalis (Wiedemann) was identified by Dr. C. H. Curran (1928-111) from Aibonito.

Mericina ruficauda Curran (1927-6), described from a single male from Arecibo, has very long pteropleural bristles, general color "black; fourth abdominal segments reddish, length 7.5 mm."

Ricosia setigena Curran (1927-5), described from a single female from Aibonito, is "black, the palpi and first two and base of third antennal segment reddish; length 7.0 mm."

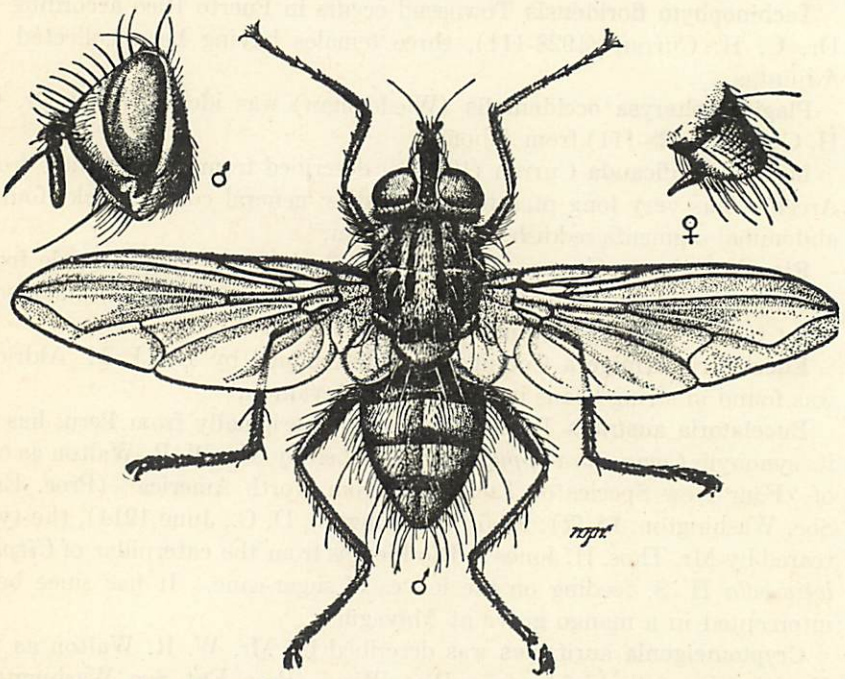
Eucelatoria armigera Coquillett, as determined by Dr. J. M. Aldrich, was found in string beans intercepted at Bayamón.

Eucelatoria australis Townsend, described originally from Peru, has as its synonym *Compsilura oppugnator* described by Mr. W. R. Walton as one of "Four New Species of Tachinidae from North America" (Proc. Ent. Soc. Washington, 16 (2): 93–5. Washington, D. C., June 1914), the type reared by Mr. Thos. H. Jones at Río Piedras from the caterpillar of *Cirphis latiuscula* H. S. feeding on the leaves of sugar-cane. It has since been intercepted in a mango grove at Mayagüez.

Cryptomeigenia aurifacies was described by Mr. W. R. Walton as "A New Species of Tachinidae from Porto Rico" (Proc. Ent. Soc. Washington, 14 (4): 198–200, pl. 1. Washington, D. C., January 10, 1912) from flies reared by Mr. D. L. Van Dine at Hacienda Librada, Central Pagán, Añasco, "from puparia found within the body shells of adult *Lachnosterna* at the roots of coffee," April 29, 1912. So important a parasite of the adults of white grubs did this appear to be that several attempts were made to establish it at Hda. Santa Rita, Guánica, but without apparent success. Indeed, it appears to be restricted to the moister portion of the Island, and later investigations by the British Entomologist, Mr. W. F. Jepson, indicated that hardly more than one percent of the beetles was attacked, even in environments most favorable to this Tachinid fly. Mr. E. G. Smyth (1917-56, 86 to 87, 151) noted that "the number of pupae found

within one dead adult host varies from two to nine, usually four to six. Infested beetles that have died are always found in their burrows in the ground." The adult flies have been collected at Río Piedras, Guaynabo, Pueblo Viejo and Cidra, usually in citrus groves or coffee groves, and not in open cane fields where maximum damage by white grubs occurs.

Eutrixoides jonesii was described by Mr. W. R. Walton as one of some "New North American Tachinidae" (Entomological News, 24 (2): 49-51, pl. 1. Philadelphia, February 1913) from two adults reared by Mr. Thos. H. Jones at Hda. Librada, Central Pagán, Añasco, May 16, 1912,



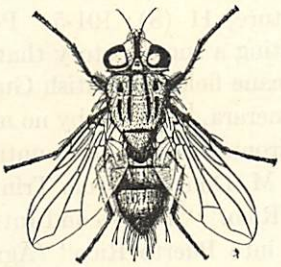
The endemic Tachinid (Larvaevorid) Parasite of May Beetles in Puerto Rico, *Cryptomeigenia aurifacies* Walton, ten times natural size. (Drawn by W. R. Walton.)

from pupae within dead May beetles. This is apparently the less common of these two Tachinid flies attacking May beetles, and altho occurring generally in the same humid environment, in 1933 was so scarce that it was not found at all by Mr. Walter F. Jepson at any point where he searched for it, either at Añasco, Isabela, Manatí or Cidra.

Lixophaga diatraeae (Townsend), the endemic Tachinid attacking the larvae of the sugar-cane moth-borer, *Diatraea saccharalis* (F.), was first reported from Puerto Rico by Mr. D. L. Van Dine (1912-17) as *Hypostena* sp., and (1913-29 and 1913-254) as *Tachinophyto* sp. *Euzenilliopsis diatraeae* Townsend is the name given by Mr. Harold E. Box in his "Report

F. Martorell found that parasitism at Yabucoa was approximately 65 percent, but during the dry spring of 1948, only 18 percent, while on the dry south coast it reached a maximum of 12 percent in May 1930 at Hda. Potala.

Paratheresia claripalpis (Van der Wulp), the endemic parasite of the larvae of the sugar-cane moth-borer (*Diatraea saccharalis*) in South America, has been repeatedly introduced into Puerto Rico, in the hope that it might at least supplement *Lixophaga diatraeae* in the less humid environments. The work of Mr. S. M. Dohanian in "The Introduction of Parasites of the Sugarcane Borer into Puerto Rico" (Jour. Agr. Univ. P. R., 21 (2): 237–241. Río Piedras, July 1937) rearing the fly in Trinidad and later in Peru, was only the beginning of a series of shipments, as recorded in the Reports of the Mayagüez Station (1938-96, 1939-96, 1940-102, 1942-67), to establish this parasite in Puerto Rico. The latest development



The endemic Tachinid (Larvaevorid) fly, *Lixophaga diatraeae* TT, parasitic on the larvae of *Diatraea saccharalis* (F.), five times natural size. (Drawn by Harry Bradford. After Holloway, Haley & Loftin, Bureau of Entomology, U. S. D. A.)

upon a Trip to Porto Rico, April-July, 1924" (for private circulation) S. Davson & Company, Ltd., pp. 22. Berbice, British Guiana, November 1924). In his account of collections of pupae of the fly and parasitized *Diatraea* larvae from borer dead-hearts between Trujillo Alto and Río Piedras, and between Bayamón and San Patricio, he found a maximum parasitism of 23 percent near Bayamón during May, and not more than 5 percent on Vieques Island. His "Observations upon *Lixophaga diatraeae*, Townsend, a Tachinid Parasite of *Diatraea saccharalis*, in Porto Rico" (Bull. Ent. Research, 19 (1): 1–6, fig. 1, ref. 11. London, August 1928) give the known distribution, outside of Puerto Rico and Vieques, as Cuba and Santo Domingo. It is his opinion that "the efficiency of *Lixophaga* can not be artificially increased (in Puerto Rico) in any way, as it seems that this parasite has reached its maximum effectiveness." When introduced into the cane fields of Florida, however, it may be a very effective parasite, but unfortunately does not survive severe winters, thus fresh introductions must be made each spring. In the spring of 1946, Dr. Luis

was in the introduction of xerophytic races from Itaquaquecetuba, in the State of Sao Paulo, Brasil, such as *P. diatraeae* (Bréthes). This is at most an ecological sub-species, as is shown by Dr. F. I. van Emden (Rev. de Entomologia **20** (1–3): 499–508. Río de Janeiro, August 1949), discussing "The Scientific Name of the Common Tachinid Parasite of *Diatraea* spp. in Central and South America." From the second generation reared in Puerto Rico, releases were made in all parts of the Island of 981 flies, according to Dr. Kenneth A. Bartlett in the "Report of the Puerto Rico Experiment Station 1941" (1942-24).

Metagonistylum minense was described from specimens from Minas Geraes, Brasil and the Bolivian Chaco by Dr. C. H. T. Townsend, with no idea that this extremely curious fly, with immense antennae, might have any economic importance and deserve a name more easily pronounced by ordinary people. Dr. J. G. Myers writes of "The Discovery and Introduction of the Amazon Fly: A New Parasite for Cane-Borers (*Diatraea* spp.)" (Tropical Agriculture, 11 (8): 191-5. Port-of-Spain, 1934) with characteristic charm, relating a success story that meant practical control of the moth-borer in the cane fields of British Guiana. Its success in the swampy cane fields of Demerara, however, by no means ensured its adaptation to quite different environments in other countries, and the first attempt at introduction by Mr. S. M. Dohanian from Trinidad (1937-237) resulted in no recoveries in Puerto Rico. "The Second Introduction of the Amazon Fly from British Guiana into Puerto Rico" (Agr. Notes No. 86, pp. 4. Mayagüez, Nov. 14, 1938) by Dr. Kenneth A. Bartlett was more successful, and in March 1939 a xerophytic strain from Sao Paulo was introduced, reared in Puerto Rico, and up to July 30, 1940, a total of 41,177 flies was liberated at 19 different points in the cane fields of Puerto Rico. Dr. Bartlett, discussing "The Biology of *Metagonistylum minense* Tns., a Parasite of the Sugar-cane Borer" (Bulletin No. 40, P. R. Expt. Station, Mayagüez, pp. 20, fig. 10, ref. 19. Washington, D. C., December 1941), reports that "at the present time the Amazona strain of the fly is considered to be well established in the Añasco Valley region, the Mayagüez, the San Germán Valley region, and on the south coast about Santa Isabel. The highest parasitization found has been 46 percent at Mayagüez, 3 years after the original liberation was made. However, in many collections, the parasitization was 1 percent or less and in many cases it was negative." The latest status examination in the 1941 Report of the Mayaguez Station (1942-67) shows recoveries in cane fields at Cabo Rojo, Santa Isabel, Guayama and Fajardo, but with low parasitizm.

Euphasiopteryx australis Townsend, "A Tachinid Parasite of the Puerto Rican Changa" (Jour. Ec. Ent., **33** (1): 202. Menasha, June 1940), has

twice been introduced into Puerto Rico, but in such small numbers that it could not become established. The pupal stage lasts exactly ten days, giving ample time for airplane shipment, but during dry weather in the Amazon region parasitizm of changa adults is only one or two percent, and even during the rainy season was found not to be more than five percent, at least in nature. In the laboratory of Belém do Pará a maximum of 25 percent of changas was parasitized, but too late in the spring rainy season of 1945 for mass rearing. The puparium is characterized by two prominent knobs terminated by three black warts; the adult is a plump, light yellowish fly with reddish eyes, of nocturnal habits, hiding in the darkest part of the cage during the day but surprisingly active at night.

Epigrimyia townsendi was described by Dr. C. H. Curran (1931-22) from a single female from Isabela Substation as being "related to *robertsoni* Townsend, but with black legs, more broadly shining segmental apices and the third vein bristled as far as the anterior cross-vein; length 5.5 mm." This genus differs from *Stomatodexia* Brauer and Bergenstamm in that "the arista is not short plumose."

Stomatodexia diadema (Wiedemann), another parasite of the larvae of the sugar-cane moth-borer (*Diatraea saccharalis*) in Trinidad and British Guiana, but in environments quite different from those most suitable for the Amazon Fly, was also introduced by Mr. S. M. Dohanian (1937-239) from Demarara into Puerto Rico, but has not since been recovered.

Stomatodexia cothurnata (Wiedemann), listed by Mr. R. H. Van Zwaluwenburg as *Leskia analis* Say (P. R. 5055), reared from *Margaronia hyalinata* L., the cucumber caterpillar, was subsequently identified from Puerto Rico by Dr. C. H. Curran (1928-114): specimens from Mayagüez, Adjuntas and Aibonito.

Leskiopalpus flavipennis (Wiedemann), originally described as a *Dexia* from Brasil, was reared by Dr. Luis F. Martorell from a larva of *Lamprosema* (or *Blepharomastix*) *ebulialis* Guenée feeding on *Heterotrichum cymosum* on El Yunque, the determination of the fly being by Mr. David G. Hall. Flies intercepted at Mayagüez and resting on croton at Bayamón were identified by Dr. J. M. Aldrich as being a species of *Leskiopalpus*, those from a grapefruit grove at Añasco as a species of *Phaenopsis*, those found resting on sour orange at Mayagüez as a species of *Cyrtoneurina*.

Beskia aelops (Walker), described originally from Georgia as a *Tachina*, and since reported from other southern states, Mexico, Brasil, and St. Vincent and Santo Domingo in the West Indies, was first identified by Dr. J. M. Aldrich from material intercepted near San Juan, and Dr. C. H. Curran identified specimens from Río Piedras in the AMC collection as being this species.

Belvosia bifasciata (Fabricius), originally described as a *Musca* from

the West Indies, and known from Brasil and Mexico and the southern and eastern United States as far north as Philadelphia, where it has been reared from large Bombycid caterpillars, was collected in Puerto Rico by Drs. Stahl and Gundlach, as identified by Herr Victor von Roeder. In a devastating outbreak of the sweet potato sphinx caterpillar, *Herse cingulata* (Fabricius), between Arecibo and Aguadilla in December 1918, Messrs. E. G. Smyth and Edgar Nelson found many parasitized by this large black Tachinid fly, three larvae occurring in each large caterpillar. In 1930 specimens were collected at Mayagüez and Yabucoa which Dr. C. H. Curran identified as this species. Its third abdominal segment basally and all of the fourth are densely dull yellowish pollinose.

Belvosia insularis was described by Dr. C. H. Curran (1927-4) from a single female from Orocovis as being "black, the head yellowish, parafrontals darker; frontal vitta rusty reddish; occiput black; length 11.0 mm."

Belvosia luteola was described by Mr. D. W. Coquillett (1900-253) from a type collected by Mr. Aug. Busck on Vieques Island.

Belvosia piurana Townsend, as determined by Dr. C. H. Townsend, collected on flowers at Río Piedras by Mr. Thos. H. Jones, is practically indistinguishable from *B. bifasciata.*

Cylindromyia atra was described as an *Ocyptera* by Herr Victor von Roeder (1885–344) from material collected by Dr. Gundlach in Puerto Rico.

Cylindromyia minor, described by Herr Victor von Roeder (1885-344) as an *Ocyptera* from specimens collected by Dr. Gundlach in Puerto Rico, was identified by Dr. C. H. Curran (1928-114) from Coamo, and others from Boquerón in the AMC collection.

Nemorilla floralis (Fallen), identified by Dr. J. M. Aldrich from flies intercepted at Mayagüez by Mr. A. G. Harley, was reared by Mr. H. K. Plank (1945-27) from caterpillars of the bean leaf-webber, *Hydelepta* (or *Lamprosema*) *indicata* (F.), at Mayagüez.

Nemorilla maculosa Macquart, of which Dr. J. M. Aldrich considers *Exorista pyste* Walker a synonym, was reared from the pupa of the cucumber caterpillar *Margaronia* (or *Diaphania*) *hyalinata* (L.) at Río Piedras by Mr. E. G. Smyth, and from "butterfly nests" of *Tetralopha scabridella* Ragonot on *Inga vera* at Cayey. The general appearance of this little fly is mostly silvery due to extensive whitish pollination.

Euphorocera claripennis (Macquart), as identified by Mr. W. R. Walton, a common parasite of the caterpillars of butterflies in the United States, was reared by Mr. Thos. H. Jones from larvae of the cane looper, *Mocis* (or *Remigia*) *repanda* (F.), at Santa Isabel. As an *Ebenia* it has since been identified from interceptions at Mayagüez. Identified by Mr. C. W. Sabrosky as *Euphorocera tachinomoides* TT, it was reared from the larvae of *Melipotis famelica* (Guenée.) at Yauco in November 1923 by Mr. Francisco Seín.

Phorocera parviteres Aldrich, as identified by Dr. J. M. Aldrich, was reared in large numbers from caterpillars of the cabbage butterfly, *Ascia* (or *Pieris*) *monuste* (L.) at Yauco, and from Geometrid caterpillars, *Melanchroia cephise* Cramer, by Mr. Francisco Seín at Rio Píedras.

Phorocera divisa Aldrich & Webber, originally described from Puerto Rico (Proc. U. S. National Museum, **63** (17): 55. Washington, D. C., 1924), is recognized by Dr. C. H. Curran (1928-109) in a male from St. Croix.

Carcelia amplexa (Coquillett), determined by Dr. J. M. Aldrich as an *Exorista* reared from the larvae of *Ecpantheria icasia* (Cramer) at Río Piedras by Mr. E. G. Smyth, is mentioned by Mr. W. F. Sellers in "The Nearctic Species of Parasitic Flies belonging to *Zenilla* and allied Genera" (Proc. U. S. National Museum, **93** (3157): 1-108. Washington, D. C., 1943) on page 63.

Carcelia flavirostris (Van der Wulp), described originally as an *Exorista* from Mexico, and also found in the Southern United States, is identified by Mr. W. F. Sellers (1943-60) as the Tachinid fly reared by Mr. R. H. Van Zwaluwenburg from the "plumilla" caterpillar of *Megalopyge krugii* (Dewitz), and by Dr. C. W. Hooker from a larva, presumably of *Mesocondyla concordalis* (Hübner), feeding on the leaves of a calabash tree (*Crescentia cujete*) at Mayagüez. More recently, as identified by Mr. C. W. Sabrosky, it was reared from a mummied woolly-bear caterpillar of *Ecpantheria icasia* (Cramer) at Cidra, some of the puparia being parasitized by the Chalcid wasp, *Brachymeria incerta* (Cresson).

Exorista tessellata was described by Herr Victor von Roeder (1885-345) from material collected in Puerto Rico by Dr. Gundlach.

Achaetoneura aletiae (Riley), originally described as a *Tachina* reared from the cotton leafworm, and found thruout the United States and southern Canada, was identified by Dr. J. M. Aldrich from Puerto Rico: reared by Mr. Francisco Seín from a chrysalis which he found at Lares on *Inga laurina*. From the caterpillars of *Alabama argillacea* Hübner in Puerto Rico, no Tachinid fly has been reared to date.

Achaetoneura archippivora (Williston) has been reared from many kinds of butterfly larvae in the United States. In Puerto Rico, as identified by Mr. W. R. Walton, it has been reared from the caterpillars of the southern grassworm, *Laphygma frugiperda* (Abbot & Smith), was first reported by Mr. D. L. Van Dine (1913-31 and 1913-257), and subsequently by Mr. Thos. H. Jones (1913-235), from many rearings at Río Piedras, and others at Mameyes, Arecibo and Sabana Grande. In November 1937 it was reared from tobacco cutworms, *Feltia subterranea* (F.) attacking cotton seedlings at Boquerón, as identified by Mr. C. W. Sabrosky.

Achaetoneura bigeminata, described by Dr. C. H. Curran (1927-9) as a *Frontina* from three males from Adjuntas, is "elongate, fairly slender;

black, including the palpi; thorax cinereous pollinose, with four broad black vittae; length, 9.0 mm." and has recently been intercepted at Vega Alta.

Achaetoneura insularis Brauer & Bergenstamm, originally described as a *Frontina* from St. Thomas, was listed by Dr. C. H. Curran (1928-110) from Orocovis, and identified from Mayagüez and many localities in all parts of Puerto Rico: specimens in the AMC collection.

Achaetoneura rufifrons, described as a *Frontina* from Puerto Rico by Herr Victor Roeder (1885-346) was collected by Dr. Gundlach and listed by him.

Argyrophylax albincisa (Wiedemann), originally described as a *Tachina* from St. Thomas, was first reported from Puerto Rico as a *Sturmia* by Dr. Richard T. Cotton (1917-113), having been reared by him from the "pegapega" of tobacco: *Psara periusalis* (Walker). It attacks other kinds of Pyralid caterpillars, having been reared from *Zinckenia perspectalis* (Fabricius) on amaranthus by Mr. E. G. Smyth; from *Hydelepta indicata* (Fabricius) on cowpeas by Mr. Thos. H. Jones; from *Mesocondylà concordalis* (Hübner) on "roble" (*Tabebaia pallida*), first by Mr. Jones, and later by Dr. Luis F. Martorell (1940–19), all of these determinations of the fly being by Dr. J. M. Aldrich. It is really a very common insect, having been repeatedly intercepted from all parts of the Island, altho Dr. C. H. Curran (1928-110) lists only a single female from Mayagüez.

Sturmia cubaecola (Jaennicke), as identified by Dr. Maurice T. James, is listed by Mr. H. K. Plank in the 1944 Report of the Mayagüez Station (1945-27) as a parasite on the bean leaf-webber, *Hydelepta indicata* (Fabricius), attacking soybeans. This material has been re-determined by Mr. C. W. Sabrosky as *Argyrophylax albincisa.*

Zygosturmia sp. was the identification by Dr. J. M. Aldrich of the Tachinid flies reared by Mr. Thos. H. Jones from a sphinx caterpillar on *Cordia,* many maggots emerging from a single caterpillar's body.

Anacamptomyia americana, as described by Dr. C. H. Curran (1937-8), "is black, the palpi, scutellum mostly and the halteres reddish; thorax yellowish gray pollinose, with five black vittae, the median and lateral ones broad, the others slender; length 7.0 mm.," the type a single female from Mayagüez, of which an illustration of the profile of the head is given.

Ormia punctata Desvoidy was first identified by Herr Victor von Roeder from Puerto Rico, and thus listed by Dr. Gunlach as a Muscid fly. Dr. J. M. Aldrich identified specimens from Pt. Cangrejos, and another from Aibonito collected by Dr. Richard T. Cotton. Dr. C. H. Curran (1931-23) gives the name *dominicana* Townsend to a single female collected by Prof. W. T. M. Forbes at Coamo, but admits that "it is possible that the specimen before me is not *dominicana.*" These flies are "all rusty yellow-

ish in color (quite similar in general appearance to the changa parasite of Brasil, *Euphasiopteryx australis* TT.), rarely with darker markings; readily recognized by the greatly swollen medianly sulcate prosternum."

Linnaemyia fulvicauda was described by Mr. W. R. Walton (1914-93) from material reared by Mr. Thos. H. Jones from larvae of the sugar-cane looper caterpillar, *Mocis* (or *Remigia*) *repanda* (Fabricius), of which additional specimens were obtained in the same year (1912) at Cayey, and by Mr. S. S. Crossman at Aibonito. Dr. C. H. Curran (1928-108) also recognised this fly: a single male from Aibonito.

Leschenaultia juriniodes (Townsend) originally described from Jamaica, was identified by Dr. J. M. Aldrich from unlabeled specimens presumably collected in Puerto Rico. These flies have extremely hairy black abdomens, but the thorax is grey with whitish pollinose.

Leschenaultia leucophrys (Wiedemann), originally described as a *Tachina* from Brasil, and reported from the greater Antilles, Central America, Mexico and the eastern United States as far north as Franconia, New Hampshire, is first listed from Puerto Rico by Dr. Gundlach. Dr. J. M. Aldrich identifies as this species unlabeled specimens which may be what Mr. E. G. Smyth reared from a dead mouse at Río Piedras, and from which heavy **Parachaeta bicolar** Macquart was also reared.

Winthemia okefenokeensis Smith is listed by Dr. C. H. Curran (1928-108) from Cuba and Jamaica, and from Manatí and Caguas, Puerto Rico.

Winthemia quadripustulata (Fabricius), originally described from Europe as a *Tachina*, and known thruout the United States east of the Rocky Mountains, was identified by Dr. J. M. Aldrich from material reared by Mr. Thos. H. Jones from the pupa of a Noctuid, possibly *Cirphis latiuscula* (H. S.), on sugar-cane at Ponce.

Winthemia sexualis was described by Dr. C. H. Curran (1927-7) from males from Arecibo and Adjuntas as being "rather similar to *okefinokensis* Smith but the abdominal pollen is much thinner and leaves wide, shining segmental fasciae, and the front tarsi are simple; it bears a large ventral sexual patch on the third tergite composed of dense brownish black hair; length 7 to 8 mm."

Voria ruralis (Fallen), as identified by Dr. Maurice T. James, is listed by Mr. H. K. Plank in the 1944 Report of the Mayaguez Station (1945-27) as a parasite of the velvetbean caterpillar, *Anticarsia gemmatilis* (Hübner), on soybeans. From the same host at Río Piedras, Mr. Thos. H. Jones reared flies which Dr. J. M. Aldrich identified as a species of **Gonia**.

Gonia crassicornis (Fabricius), originally described as a *Musca* from the West Indies, was identified by Dr. J. M. Aldrich for Mr. D. L. Van Dine (1913-31 and 1913-257) as a parasite on the southern grassworm, *Laphygma frugiperda* (Abbot & Smith), and was listed by Mr. Thos. H.

Jones (1913-235 and 1922-47). It has also been reared from a cocoon of *Xylomiges eridania* (Cramer) intercepted on potato at Cidra, and occurs in all parts of the Island, adults having been intercepted at Mayagüez and Guánica, and, as identified by Mr. C. W. Sabrosky, taken from flowers of *Borreria verticillata* at Vega Baja. As *Gonia angusta* Macquart, this fly is listed by Van Zwaluwenburg as P. R. 103: from *Lachnosterna* spp., presumably reared from dead May beetles, and not a parasite. *Gonia texensis* Reinhard, as identified by Dr. C. H. Curran (1928-107) from Jamaica, and from Manatí and Coamo in Puerto Rico, is considered a synonym by Mr. C. W. Sabrosky.

Gonia pallens Wiedemann, originally described from Brasil, was reported from Puerto Rico by Herr Victor von Roeder, but listed by Dr. Gundlach as *Gonia chilensis* Macquart. This fly occurs as far south as Patagonia, and is reported in all of the Greater Antilles and in Mexico. Mr. E. G. Smyth reared this "large grey and red-brown Tachinid" from the pupa of *Xylomiges sunia* (Guenée), at Río Piedras, the fly having been determined by Dr. J. M. Aldrich.

Peleteria robusta (Wiedemann), originally described as a *Tachina* from South America, and occurring as far north as Canada, was first collected in Puerto Rico by Dr. Gundlach and reported by him and Herr Victor von Roeder as a *Echinomyia*.

Archytas analis (Fabricius), originally described as a *Tachina* from South America, and definitely reported from St. Vincent, Santo Domingo and Jamaica, as well as widely distributed in the United States and Canada, was identified from Puerto Rico by Dr. J. M. Aldrich for Mr. Thos. H. Jones, who reared it from a cutworm on tobacco, presumably *Prodenia ornithogalli* (Guenée), at Aibonito.

Archytas antillicola was described by Dr. C. H. Curran (1927-2) from an extensive series of flies from all parts of Puerto Rico, as well as others from Jamaica and British Guiana. It is "black, antennae partly and the palpi apically, reddish; face and cheeks yellow, length 11.5 to 13.0 mm.," and of it Dr. Curran identifies numerous specimens in AMC collection: from Yabucoa, Río Piedras, Coamo, Hormigueros and Mayagüez. It has also been intercepted on El Yunque.

Archytas basifulva (Walker), originally described as an *Echinomyia* from Jamaica, was first collected in Puerto Rico by Mr. Aug. Busck, as reported by Mr. D. W. Coquillett (1900-253), and is in Van Zwaluwenburg's list as P. R. 97. Dr. C. H. Curran (1928-106) identified this fly from Coamo, and in the AMC collection, specimens from Mayagüez, Hormigueros, Tortuguero Lagoon and Yabucoa. Mr. David G. Hall identified as this species the flies which Dr. Luis F. Martorell reared from the southern armyworm, *Laphygma frugiperda* (Abbot & Smith), feeding on alfalfa at Tallaboa in November 1940.

Archytas piliventris (Van der Wulp), originally described as an *Echinomyia* from the Argentine and Mexico, was first identified from Puerto Rico by Mr. W. R. Walton as a parasite of the southern grassworm, *Laphygma frugiperda* (Abbot & Smith), feeding on malojillo and sugarcane at Río Piedras, as reported by Mr. D. L. Van Dine (1913-31, 1913-257) and Mr. Thos. H. Jones (1913-235, 1922-47). Dr. C. H. Curran (1928-107) identified this fly from St. Thomas, and from Coamo and Mayagüez in Puerto Rico, as well as specimens in the AMC collection from many other localities in all parts of the Island. As identified by Mr. C. W. Sabrosky, it was noted by Dr. Luis F. Martorell feeding at flowers of *Borreria verticillata* at Guajataca Reservoir.

Archytas seminigra (Wiedemann), originally described as a *Tachina* from Brasil, was reported as *Jurinia analis* Macquart from Puerto Rico by Herr Victor von Roeder, and thus listed by Dr. Gundlach.

Archytas incerta (Macquart), as identified by Dr. J. M. Aldrich, has been reared from caterpillars intercepted on beets at Vega Baja and on peas at Cidra.

Antillicolla auriceps was described by Dr. C. H. Curran (1927-1) from a single female from Adjuntas as being "black, the face, palpi, antennae and apex of the abdomen, reddish; head golden pollinose; wing veins bordered with brown; length, 7.0 mm.," accompanying the description with an illustration of the profile of the head.

Dinera sp. nov. was the determination by Dr. J. M. Aldrich of a fly intercepted in an orange grove at Mayagüez by Mr. A. G. Harley.

Opsodexia cruciata Reinhard, as identified by Dr. J. M. Aldrich, was intercepted in a mango grove at Mayagüez by Mr. A. G. Harley.

Rhynchodexia sororia Williston, originally described from St. Vincent, is recognized by Dr. C. H. Curran (1928-113) from Puerto Rico in an abundance of specimens from San Juan and Santurce to Maricao. He (1931-23) suggests "that this name should be replaced by *rufianalis* van der Wulp."

Rhynchodexia rufianalis van der Wulp was first collected in Puerto Rico by Mr. Aug. Busck, as reported by Mr. D. W. Coquillett (1900-254). Adults identified by Dr. J. M. Aldrich have since been collected in Isabela Grove, Pt. Salinas, and by Dr. Richard T. Cotton swept from flowers at Pt. Cangrejos.

Dexia strenua (Desvoidy), originally described from Santo Domingo as a *Zelia*, was identified from Puerto Rico by Herr Victor von Roeder, and listed by Dr. Gundlach.

Sarcophagidae: Flesh Flies

Sarcophaga lambens Wiedemann was originally described from the West Indies, and first collected in Puerto Rico by Dr. Gundlach, who listed it

under this name as identified by Herr Victor von Roeder. It was collected by Mr. Aug. Busck, as reported by Mr. D. W. Coquillett (1900-254), but most later records are under the name *Sarcophaga sternodontis* Townsend, given by Dr. J. M. Aldrich in his book "Sarcophaga and Allies in North America" (Thomas Say Foundation, pp. 342, pl. 16. Lafayette, Indiana, 1916) on page 267. *Sarcodexia sternodontis* was described by Dr. C. H. T. Townsend from Jamaica, reared from a dead Cerambycid beetle, and from a dead scorpion. As a *Sarcophaga* in Puerto Rico it was reported reared from the pupae of the cotton leaf caterpillar, *Alabama argillacea* (Hübner), at Hatillo (Wolcott 1924-56), and from white grubs and the pupae of the sugar-cane looper caterpillar, *Mocis* (or *Remigia*) *repanda* (Fabricius), by Jones & Wolcott (1922-49). The long list of localities noted by Dr. C. H. Curran (1928-99) gives some indication of the abundance of this particular Scarcophagid fly, as in the collection at Río Piedras reared adults are more numerous than all other members of the family. In addition to the hosts mentioned it has been reared from dead May beetles, from dead spiders, from dead tobacco hornworms and other sphinx caterpillars and moths, from southern grassworm pupae, from dead changa, from dead grasshoppers and from dead cockroach. Altho it is possible that the pupae of the cotton leafworm and of the southern grassworm were still alive when attacked by this fly, it is much more probable that they were already dead, for the normal habit of the ovipositing female is to lay her eggs only on dead invertebrates. Many of the rearing records are accidental, so far as the entomologist is concerned, for if his large insects are not placed in a screened cage for drying, the female fly will discover his carelessness, and a few days later maggots will drop from the body of the insect, having devoured all the soft parts within its horny skeleton, and left the specimen in really much better shape for the collection than if it contained all its internal organs. Growth and development of the maggots are necessarily very rapid, for their food supply is limited in amount and decaying rapidly. The adult flies have four silvery white pollinose stripes on the thorax, and interrupted and less dense pollinose bands on the abdomen, and in size may be somewhat smaller or considerably larger than houseflies, depending upon the nourishment available to the maggots. In San Juan maggots have been intercepted feeding on yeast, and reared to adult on this medium alone. Dr. Maurice T. James, discussing this representative of "The Flies that cause Myiasis in Man" (U. S. D. A. Misc. Publication No. 631, pp. 175, fig. 98, ref. 160. Washington, D. C., 1947), on page 52 states that "the larvae breed in various substances, including carrion and excrement; they have been found to be parasitic on a large number of insects." On the basis of our experience in Puerto Rico the latter statement can hardly be considered correct and

should read that they are scavengers on dead insects. As indicated by Dr. James, the distribution of this fly includes the southeastern United States, the neotropical region with specific records for many of the Lesser Antilles extending to Paraguay and Agrentina in South America.

Sarcophaga amoena Aldrich, originally described from Dominica, B. W. I., has been reared from an injured snail from Lares, and adults collected from malojillo or resting on corn leaves at Río Piedras, as identified by Dr. J. M. Aldrich. The male is 9 mm. long; the female 6.5 mm.

Sarcophaga alcedo Aldrich, as determined by Mr. David C. Hall, was found by Dr. Kenneth A. Bartlett occurring in the shipping cages in which adults of *Canthon pilularius* (L.) were sent from Texas. Reporting on "The Dung Rolling Beetle as a Host of a Sarcophagid Parasite" (Jour. Ec. Ent., **32** (1): 150. Menasha, February 1939), he found that "the adult flies deposit living larvae," which "are able to penetrate the integument of the (living) beetle at any point, but the majority enter through the thinner chitinized portions of the abdomen," attaining full size in from three to seven days. *Copris incertus* Say was also successfully parasitized.

Sarcophaga australis Aldrich, as identified by its describer, has been intercepted in Isabela Grove, Palo Seco.

Sarcophaga bakeri Aldrich, originally described from Cuba, was first identified from Puerto Rico by its describer from material collected by Mr. R. H. Van Zwaluwenburg at Mayagüez, as listed in "Insectae Portoricensis" (1923-224), and subsequently has been intercepted at Loíza, San Juan and Barceloneta. Dr. C. H. Curran (1928-99) identifies many specimens from Puerto Rico, from El Yunque to Ensenada, as well as from Mona Island and St. Thomas.

Sarcophaga capitata was described by Dr. J. M. Aldrich (1916-209), the types from Mayagüez and Arecibo, as "like *amoena*, but has head-pollen and beard quite deep yellow, length of male 15 mm.; of female 11 mm.," and quite the largest of any Puerto Rican Sarcophagid. Dr. C. H. Curran (1928-98) identifies this fly from additional localities and in the AMC collection as far east as San Juan and Río Piedras.

Sarcophaga culminata was described by Dr. J. M. Aldrich (1916-289), the type from Mayagüez: a single male. It is by no means rare in Puerto Rico, however, for it has since been intercepted on El Yunque, and Dr. C. H. Curran (1928-99) identifies specimens from there, Naguabo, San Juan, Adjuntas and Jayuya.

Sarcophaga currani Hall, as determined by Mr. D. G. Hall, was found in Viejo Lirio cave, on Mona Island by Dr. Luis F. Martorell. It was originally described from Cuba.

Sarcophaga globulus Aldrich, originally described from Cuba, is listed

from Mona Island and Puerto Rico by Dr. C. H. Curran (1928-100) as in the sub-genus *Helicobia*, with specimens from Naguabo, Manatí, Aibonito, Adjuntas and Orocovis.

Sarcophaga latisetosa (Parker) was identified from Puerto Rico by Dr. C. H. Curran (1928-100) at many localities from San Juan to Ensenada, and in the mountains at Aibonito.

Sarcophaga morionella Aldrich, as determined by its describer, has been intercepted at Bayamón, and repeatedly in orange or mango groves at Mayagüez, and in a coffee grove at Maricao.

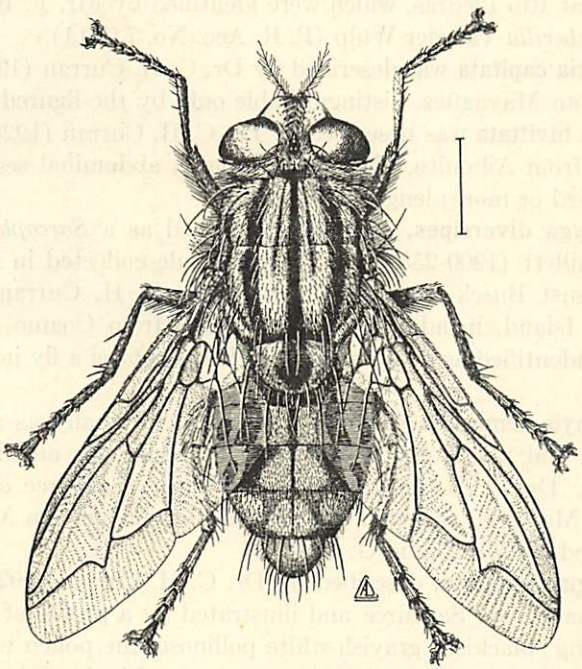
Sarcophaga peltata was described by Dr. J. M. Aldrich (1916-216), the type from Mayagüez, (R. H. Van Zwaluwenburg) and Naguabo, others from Cuba, Florida and the Bahamas. It is very common in Puerto Rico, Dr. C. H. Curran (1928-98) identifying it from many other localities and in the AMC collection from Las Marías and Maricao to Ponce, Yauco and Cabo Rojo. It has repeatedly been collected or intercepted in grapefruit groves, intercepted in decaying cucumbers at Bayamón, and found in trees of "jobo" (*Spondias mombin*) at Río Piedras when the fruit is so ripe as to be falling from the tree.

Sarcophaga plinthopyga Wiedemann was originally described from St. Thomas, but it has a very extensive distribution from Nova Scotia in Canada, thruout the western United States and in the neotropics as far south as Sao Paulo and west as the Galapagos. It was identified from Puerto Rico by Herr Victor von Roeder, and listed by him and Dr. Gundlach, and collected by Mr. August Busck as indicated by Mr. D. W. Coquillett, but apparently is not very common, for Dr. J. M. Aldrich (1916-268) as *Sarcophaga robusta* Aldrich, notes but a single specimen from Mayagüez, and Dr. C. H. Curran (1931-22) a single male from Vieques. The AMC collection contains numerous specimens from Mayaguez and a few from Añasco, Utuado, Río Piedras and Yabucoa. Dr. Luis F. Martorell collected it on flowers of "botoncillo" (*Borreria verticellata*) at Isabela, as identified by Mr. David G. Hall. Dr. Maurice T. James (1947-51) reproduces an illustration of this fly, noting that its "larvae differ in their feeding habits and are commonly found on carcases or as parasities in the bodies of insects. However, they frequently attack old and festered sores in man and animals, or invade diseased body opening." In Puerto Rico these flies do not show the "notorious myiasis-producing" habits reported from Trinidad and British Guiana.

Sarcophaga (Helicobia) quadrisetosa Coquillett is listed by Dr. Ralph R. Parker in his "Sarcophagidae of New England" (Proc. Boston Soc. Natural History, **35** (1)- 1-77, pl. 8. Boston, 1914) on page 60 as occurring in Puerto Rico.

Sarcophaga (Helicobia) surrubea Van der Wulp, described originally from Mexico, is identified by Dr. C. H. Curran (1928-101) from the Virgin Islands of St. Croix, St. John and St. Thomas, as well as from numerous localities in Puerto Rico from El Yunque to Ensenada.

Sarcophaga (Helicobia) rapax Walker, as identified by Dr. M. T. James, was reared from a dead rhinoceros beetle, *Strataegus barbigerus* Chapin, from Mona Island. As *Sarcophaga helicis* Townsend, "one of the commonest North American species" according to Dr. Aldrich (1916-159), it was collected in Puerto Rico by Mr. August Busck, as reported by Mr. D. W.



Adult male of *Sarcophaga plinthopyga* Wiedemann, ten to fifteen times natural size. (Drawn by Arthur D. Cushman. After James, U. S. D. A.)

Coquillett (1900-255), and is reported from numerous Puerto Rican localities by Dr. C. H. Curran (1928-101), as well as from Mona Island. Mr. Thos. H. Jones (and Wolcott 1922-49) reared this fly from a caterpillar of the sugar-cane looper, *Mocis* (or *Remigia*) *repanda* (Fabricius), feeding on grass at La Plata in February 1912, and apparently it is a true parasite.

Sarcophaga taurus Aldrich, originally described from Naguabo, has since been intercepted at San Juan. The male is 14.0 mm. long, or almost as large as *Sarcophaga capitata.*

Sarcophagula occidua (Fabricius), originally described as a *Musca* from the West Indies, was first collected in Puerto Rico by Mr. August Busck, as reported by Mr. D. W. Coquillett (1900-254), and is listed by Dr. C. H. Curran (1928-101) from the Virgin Islands of St. Croix, St. John and St. Thomas, from numerous Puerto Rican localities from Naguabo and Fajardo to Adjuntas and Mayagüez, and from Mona Island. It has been repeatedly intercepted in all parts of the Island, resting on non-significant hosts varying from the hedge of "café de la India" (*Chalcas exotica*) around the Post Office Building in San Juan to rotten cucumbers at Bayamón. Mr. Thos. H. Jones collected fourteen of these little grey flies on cattle dung at Río Piedras, which were identified by Mr. F. Knab as *Sarcophagula imbecilla* Van der Wulp (P. R. Acc. No. 745-14).

Sarcofahrtia capitata was described by Dr. C. H. Curran (1928-96) from male flies from Mayagüez, distinguishable only by the figured genitalia.

Johnsonia bivittata was described by Dr. C. H. Curran (1928-95) from a single male from Aibonito, "having the fourth abdominal segment black on apical third or more; length 3.75 mm."

Harpagopyga diversipes, originally described as a *Sarcophaga* by Mr. D. W. Coquillett (1900-255) from a single male collected in Puerto Rico by Mr. August Busck, was identified by Dr. C. H. Curran (1928-101) from Mona Island, in addition to a specimen from Coamo. Dr. J. W. Aldrich has identified as a new species of *Harpagopyga* a fly intercepted at Arecibo.

Sarothromyia femoralis (Schiner), described originally as a *Sarcophila* from Brasil, and previously known from the Bahamas and Florida, was identified by Dr. C. H. Curran (1928-101) from Santurce and Arecibo. Dr. Luis F. Martorell collected one of these flies at light on Mona Island, as determined by Mr. David G. Hall.

Sarcophagina candida, described by Dr. C. H. Curran (1928-102) from a single female from Santurce and illustrated by a profile of the head, is "8.5 mm. long; blackish; grayish-white pollinose, the pollen with a strong golden yellow tinge in some views; mesonotum with three darker vittae."

Pachyophthalmus floridensis (Townsend), originally described as a *Sarcomacronychia*, and previously known from the southern United States, is identified by Dr. C. H. Curran (1928-103) from Haiti and Jamaica, and from San Juan, Puerto Rico.

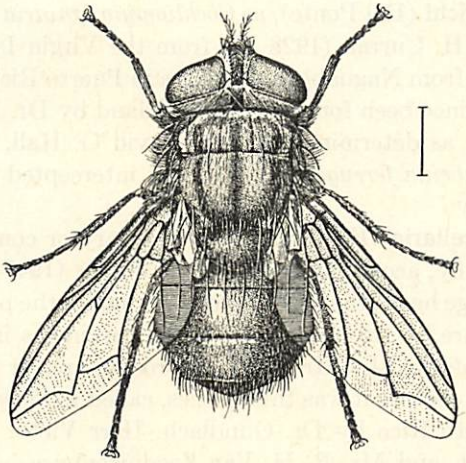
Senotainia rubriventris Macquart, originally described from Texas, but occurring thruout the United States, is identified by Dr. C. H. Curran (1928-103) from Mona Island, and from Ensenada, Mayagüez, Coamo and Caguas in Puerto Rico.

Scenetes cardini are described by Mr. J. R. Malloch as "A New Genus and Species of Muscidae from Puerto Rico" (Proc. Ent. Soc. Washington,

38 (1): 9-10. Washington, D. C., January 1936), the type from Cuba, others reared from guava at Mayagüez by Mr. A. G. Harley and Dr. K. A. Bartlett. Mr. Francisco Seín noted the creamy white maggots with two black dots on the hind end in rotten oranges at Mayagüez in December 1925, and reared adults which were determined by Mr. C. W. Sabrosky.

Graphomya stipata Walker, as identified by Dr. J. M. Aldrich, was intercepted on mango blossoms at Mayagüez.

Graphomya maculata Scopoli, as identified by Dr. J. M. Aldrich, was intercepted at Ponce by Mr. R. G. Oakley.



Adult female of the Primary Screwworm, *Callitroga americana* (Cushing & Patton), eight times natural size. (Drawn by Arthur D. Cushman. After James, U. S. D. A.)

Calliphoridae: Blow Flies

The book entitled "The Blowflies of North America" (pp. 477, pl. 46, Volume 4 of the Thomas Say Foundation. Baltimore, January 1948) by Mr. David G. Hall is a systematic account of the Calliphoridae, giving extensive data on life-history and habits, descriptions, bibliography and up-to-date synonymy, with distribution records for the species found in the West Indies and often referring more particularly to Puerto Rico.

Callitroga americana (Cushing and Patton), the primary screwworm, was not recognized as distinct from *Callitroga macellaria* (Fabricius), the secondary or common screwworm fly, until 1933, and it is quite possible that the early records of the latter by Dr. H. L. Van Volkenberg (1932–25) refer to the former species. What was originally described as *Cochliomyia americana* Cushing and Patton is a bluish or bluish-green fly, with "black hair on the lower as well as on the upper part of the parafrontalia," according to

Dr. M. T. James (1947-63). Under this name, Dr. H. L. Van Volkenberg in his paper on the "Parasites and Parasitic Diseases of Cattle in Puerto Rico" (P. R. Expt. Station Bulletin No. 36, fig. 4. Washington, D. C., October 1934) gives the life-history and control notes, and in his "Annotated Check List of the Parasites of Animals in Puerto Rico" (P. R. Expt. Station Circular No. 22 pp. 12, ref. 49. Washington, D. C., January 1939) states that "the fly, as determined by Mr. Emory C. Cushing is common and widespread, but owing to prompt treatments of wounds, it does not cause much damage to livestock." Dr. H. L. Dozier reared this fly from maggots in wounds in ox at Mayagüez and Guánica in 1935.

Callitroga aldrichi (Del Ponte), as *Cochliomyia laniaria* Aldrich was identified by Dr. C. H. Curran (1928–92) from the Virgin Islands of St. John and St. Thomas, from Naguabo and Jayuya in Puerto Rico, and from Mona Island. It has since been found on Mona Island by Dr. Luis F. Martorell, who collected it, as determined by Mr. David G. Hall, on the flowers of "abejuelo" (*Colubrina ferruginosa*). It was intercepted by Mayagüez by Mr. A. G. Harley.

Callitroga macellaria (Fabricius) the secondary or common screwworm, is a greenbodied fly, according to Dr. M. T. James (1947-65), "with a predominantly orange head; the hair of the lower half of the parafrontals yellow and of fine texture." All except one of the specimens in the Río Piedras collection, as confirmed by Mr. C. W. Sabrosky, appear to be this species. According to the records it was this species, called a *Chrysomyia*, which was listed from Puerto Rico by Dr. Gundlach, Herr Victor von Roeder, Mr. D. W. Coquillett, and Mr. R. H. Van Zwaluwenburg. As a *Cochliomyia* it is recorded by Mr. J. A. Stevenson (1918–150) and by Miss Vera K. Charles (1941–720) as host of the fungus *Cordyceps dipterigena* Berk. & Br., and identified by Dr. C. H. Curran (1928–92) from the Virgin Islands of St. Croix, St. John and St. Thomas, from numerous localities in Puerto Rico, and from Mona Island. Before fish were iced on Mona Island the fishermen claimed that this fly was so abundant and troublesome as to prevent their being dried on the beach. Dr. Richard T. Cotton reports these flies "attracted in huge swarms to a tank of gasoline that was being pumped out" at Río Piedras in November 1917, and individuals have repeatedly been collected resting on corn leaves or in grapefruit groves. According to Dr. James (1947–65), it is "primarily a scavenger and may be very abundant in carrion; the adult feeds on a variety of food, from garbage refuse to the nectar of flowers."

Callitroga minima (Shannon) was described as a *Cochliomyia* from the Dominican Republic, and, as identified by Mr. C. W. Sabrosky, was collected at Aibonito, Puerto Rico by Mr. S. S. Crossman, July 1, 1913.

Phaenicia purpurescens (Walker) has been identified by Mr. C. W. Sabrosky from Puerto Rico.

Phaenicia cluvia (Walker) was found by Mr. Raymond C. Shannon in his "Synopsis of American Calliphoridae" (Proc. Ent. Soc. Washington, **28** (6): 115–139. Washington, D. C., June 1926) to have as a synonym *Lucilia pilatei* Hough, which he had recorded from Fajardo, Puerto Rico in his redescription in "Nearctic Calliphorida, Luciliini" (Insecutor Inscitiae Menstruus, **12** (4–6): 67–81. Washington, D. C., April–June, 1924). It is "a bright green species with post margin of second tergite dark blue, without much trace of silvery pollenosity; size variable."

Phaenicia eximia (Wiedemann) as identified by Mr. David G. Hall, was collected on Mona Island by Dr. Luis F. Martorell. According to Mr. Hall (1948–239), this "blue-green species with the abdomen highly polished" is what Herr Victor von Roeder (1885–347) re-described from material collected by Dr. Gundlach in Puerto Rico under the name of *Lucilia ruficornis* Macquart. It was also listed from Puerto Rico by Mr. D. W. Coquillett, and is known to occur in St. Vincent as well as in the southeastern United States as indicated by Mr. Shannon. *Lucilia hirtiforceps* Shannon, originally described from Panama, Costa Rica and Mexico, identified by Dr. C. H. Curran (1928–93) from Desecheo Island and Mayagüez, Puerto Rico, is aother synonym for *eximia*, according to Mr. Hall. Still another synonym is the *Musca ochricornis* Wiedemann, originally described from Brasil and known also from Cuba. Under this name Herr Victor von Roeder identified material collected by Drs. Stahl and Gundlach in Puerto Rico. As a *Pyrellia* it was noted by Mr. D. W. Coquillett as having been collected in Puerto Rico by Mr. Aug. Busck, and Dr. C. H. Curran (1928–91), altho admtting only having "seen it from adjacent islands," subsequently identified many specimens in the AMC collection from all parts of Puerto Rico. Dr. Richard T. Cotton collected specimens, identified by Dr. Aldrich as *Pyrellia ochricornis* Wd., from near dung at Río Piedras, and in a citrus grove at Vega Alta, but the largest number he saw was "in a tub half full of water and decaying vegetation in which large white maggots were wiggling vigorously. Some of the adults that had emerged had been unable to get out of the water and were drowned."

Phaenicia rica (Shannon) is "a medium-sized greenish-blue species with the habitus of *eximia*" according to Mr. Hall (1948–257). Originally described as a *Lucilia* from Antigua, B. W. I., it was identified by Dr. C. H. Curran (1928–93) from specimens collected at Mayagüez, Arecibo and Naranjito, Puerto Rico. It is probable that the *Somomyia semiviolacae* described by J. Bigot from Puerto Rico in "Dipteres noveaux ou peu connus" (Annales Ent. Soc. France, No. **5**, pt. 7, p. 46. Paris, 1877) is a syno-

nym, but the type is in too poor a state of preservation for accurate determination.

The record of *Lucilia caesar* (Linnaeus) given by Mr. Coquillett is presumably in error, for this common European green bottle fly does not occur in North America or the West Indies.

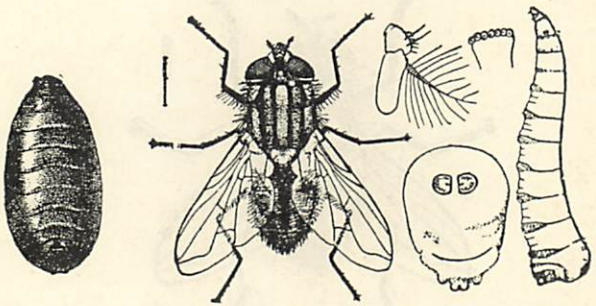
Muscidae: House Flies or "Muscids."

Morellia scapulata (Bigot), originally described as *Pyrellia* from Haiti and Mexico, and thus identified by Dr. J. M. Aldrich, was first noted in abundance in Puerto Rico in August 1921 at Río Piedras, when many of these blue bottle flies were noted on corn leaves and resting on the under side of coffee leaves in the coffee grove at that time opposite Central Vannina. Four species of aerial lizards found them sufficiently abundant and easy to catch as to form a considerable item in their food, and indeed they are reasonably abundant at all times in at least the more humid sections of the Island, as is indicated by numerous interceptions on various non-significant hosts. When trees of "jobo" (*Spondias mombin*) mature fruit, these blue bottle flies are more in evidence than the fruitflies whose maggots develop in the fruits, altho they have been observed only feeding on the exuding juice. Dr. C. H. Curran (1928–91) notes that they are separable from the other species of *Morellia* by having "humeri yellow," and lists collections in the Virgin Islands of St. Croix, St. John and St. Thomas, as well as in numerous localities in Puerto Rico, of which the most xerophytic are Coamo and Mayagüez.

Morellia violacea (Fabricius) is distinctively iridescent or metallic purplish in body color, in addition to having "humeri metallic" noted by Dr. C. H. Curran (1928–91). Altho not especially abundant, this purple bottle fly was collected by Dr. Gundlach, and is listed by him, as identified by Herr Victor von Roeder, as *Pyrellia centralis* Loew. Dr. Alex. Wetmore found it eaten by the wood pewee, and it is possibly most often to be found in the mountains, when numerous interceptions have been made in orange or coffee groves.

Musca domestica Linnaeus, the common house fly, was listed by Drs. Stahl and Gundlach, by von Roeder and Coquillett, and is number 1717 in Van Zwaluwenburg's list. Dr. C. H. Curran (1928–91) lists it from San Juan and Santurce, and identified it in the AMC collection from many other insular localities. It has been determined from Mona Island by Mr. David G. Hall, and noted in airplanes between Puerto Rico and Mona, and between Puerto Rico and Vieques Island. Despite the numerous records it is not nearly as abundant at the present time, when automobiles supply the bulk of the transportation, as when all or most of the transportation requirements of the Island depended on horses or mules. This is especially notice-

able in Río Piedras, where a livery stable opposite the first stop after leaving "entrada del trolley" invariably filled the street-car with flies. Piles of fresh "cachaza" or filter press cake are the only other major breeding-places for the flies, the heat of its decomposition being essential for the mass development of fly maggots however, so that spreading the cachaza in the fields promptly abates the plague. Flies identified by Dr. J. M. Aldrich have developed from maggots in the trunk of a rotten palm tree at Añasco, and from others intercepted in rotten pumpkins at Arroyo. In the artificial rearing of fruitfly parasites the immature stages of the house fly have proved most useful because of abundance and ready availability at all times of year, having been used by Dr. K. A. Bartlett (1939–6) for *Spalangia philippinensis* Fullaway, *Dirhinus giffardi* Silvestri and *Muscidifurax raptor* Girault & Sanders.



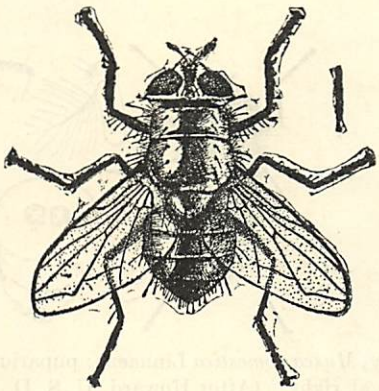
The common House Fly, *Musca domestica* Linnaeus: puparium at left, adult center, larva and enlarged parts at right. (After Howard, U. S. D. A.)

Synthesiomyia nudiseta Van der Wulp, of which S. *brasiliana* Brauer and Bergenstamm is a synonym, has been identified by Dr. J. M. Aldrich: flies collected at Río Piedras of which the presence of the silvery pollenosity on their thorax appears to change with the angle at which it is observed.

Stomoxys calcitrans (Linnaeus), originally described as a *Conops* from Sweden, is by now an international pest of livestock, having been present in Puerto Rico at least as far back as when Dr. Gundlach made the first collection here. This stablefly, or biting housefly, was noted on Vieques Island by Mr. Aug. Busck, but has not been recorded from Mona Island, presumably because the only large domestic animals there are cows, pigs and goats, and this fly prefers horses to bite and horse manure in which to lay its eggs. Dr. F. M. Root (1922–405) notes it "feeding on cattle, horses and goats." Dr. H. L. Van Volkenberg (1939–4) concludes that it is "common but not very abundant."

Siphona irritans (Linnaeus), the horn fly, or "mosca del ganado," is a

comparatively recent arrival in Puerto Rico, for it was not collected by Dr. Gundlach or Mr. Aug. Busck, and the first local record is in Van Zwaluwenburg's list, where it is called *Lyperosia irritans* L. It is presumed that the horn fly was brought to Puerto Rico in importations of livestock from the southern states sometime after the American occupation: the adults on cattle and mules, and the immature stages in their excrement. If not first established in the southwestern corner of the Island, the horn fly is certainly most abundant there now, and indeed has been ever since it was first noted. Mr. G. B. Merrill was stationed at Hda. Santa Rita, Guánica, and upon observations made on the life-history, bionomics, parasites, predators and comensals in this region is based his "Progress Report on Investigations relative to the Horn-Fly" (*in* Third Report, Board of Commissioners of

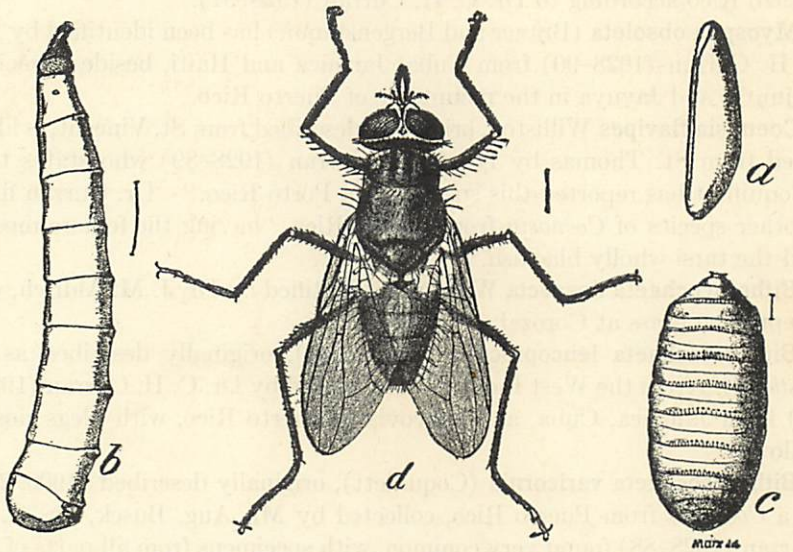


The common Stablefly, *Stomoxys calcitrans* (Linnaeus), six times natural size. (After Howard, U. S. D. A.)

Agr. P. R., 1913–14, pp. 53–54. San Juan, 1915), in which the name used is *Haematobia serrata* Desvoidy. Despite the brevity of this report, later writers on the horn fly in Puerto Rico have added surprisingly little to what Mr. Merrill recorded, until Dr. Kenneth A. Bartlett's account of "The Introduction into Puerto Rico of Beneficial Insects to aid in the Control of the Horn Fly of Cattle" (Agr. Notes No. 88, pp. 6, P. R. Expt. Station, Mayagüez, March 31, 1939). Desirable as biologic control may be theoretically, the possibility of using DDT for spraying the cattle in the regions where the horn fly is most abundant for a time made other methods academic. Because of the development of DDT-resistant strains of flies however, methoxychlor, toxaphene or other chlorinated hydrocarbon is now to be preferred. Dr. H. L. Van Volkenberg (1939-4) considers the horn fly "common and widespread but not very abundant except in the dry southern coastal plain," and it has not been noted at all in the mountain,

and but rarely in the more humid sections of Puerto Rico. Dr. M. D. Leonard (1933–130) records it from Vieques Island, but it has not been found on Mona.

Neomuscina tripunctata (Van der Wulp), of which Dr. J. M. Aldrich considers *N. cavicola* Townsend a synonym, was collected in Puerto Rico by Mr. Aug. Busck, as identified by Mr. D. W. Coquillett.



The Horn Fly of Cattle, *Siphona irritans* (Linnaeus): *a*, egg, *b*, larva, *c*, puparium *d*, adult, ten times natural size. (After Howard, U. S. D. A.)

Anthomyiidae: Root Maggots

Atherigona excisa Thomson, of which Dr. J. M. Aldrich gives as synonyms *A. orientalis* Schiner and *A. pulvinata* Grimshaw, was determined by him for Dr. Richard T. Cotton, who first in Puerto Rico reared these slender grey flies with broadly oval wings from decaying eggplant. Subsequently it has been repeatedly intercepted as maggots from decaying oranges at Barceloneta and Mayagüez, from kernels of corn, in decaying string beans at Isabela, in decaying tomatoes at Aguadilla and Isabela, from roots of dasheen and from the fruit of cashew or "pajuíl" (*Anacardium occidentale*) at Bayamón.

Ophyra aenescens (Wiedemann), originally described as an *Anthomyia* from New Orleans and the West Indies, was collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder, and has since been intercepted at Mayagüez by Mr. A. G. Harley.

Limnophora arcuata Stein, listed by Mr. D. W. Coquillett (1900–256) as

occurring in Puerto Rico, having been collected in 1899 by Mr. Aug. Busck, is identified by Dr. C. H. Curran (1928–91) from Naguabo and Mayagüez. It has since been intercepted at Naguabo, San Juan and Arecibo.

Limnophora narona (Walker), originally described as an *Anthomyia* from Florida, was intercepted resting on melon leaves at Caguas, as identified by Dr. J. M. Aldrich. Another species of *Limnophora* is also present in Puerto Rico according to Dr. C. H. Curran (1928–91).

Myospila obsoleta (Brauer and Bergenstamm) has been identified by Dr. C. H. Curran (1928–90) from Cuba, Jamaica and Haiti, besides Arecibo, Adjuntas and Jayuya in the mountains of Puerto Rico.

Coenosia flavipes Williston, originally described from St. Vincent, is identified from St. Thomas by Dr. C. H. Curran (1928–89) who states that "Coquillett has reported this species from Porto Rico." Dr. Curran finds another species of *Coenosia* from Puerto Rico, "having the femora mostly and the tarsi wholly blackish."

Bithoracochaeta despecta Walker, as identified by Dr. J. M. Aldrich, was swept from grass at Corozal.

Bithoracochaeta leucoprocta (Wiedemann), originally described as an *Anthomyia* from the West Indies, was identified by Dr. C. H. Curran (1928–87) from Jamaica, Cuba, and Orocovis in Puerto Rico, with "legs mostly yellow."

Bithoracochaeta varicornis (Coquillett), originally described (1900–256) as a *Coenosia* from Puerto Rico, collected by Mr. Aug. Busck, Dr. C. H. Curran (1928–88) found very common, with specimens from all parts of the Island, with "legs mostly black."

Leucomelina corvina Giglio-Tos, as identified by Dr. J. M. Aldrich, swept from weeds at Río Piedras, intercepted on orange flowers at Adjuntas and on grapefruit leaf at Barceloneta, was previously known from Mexico. Dr. Aldrich identifies a *Leucomelina* intercepted on El Yunque as being a new species.

Lispe rufitibialis Macquart, originally described from South America, was identified by Mr. D. W. Coquillett (1900–256) as having been collected by Mr. Aug. Busck at Fajardo and on Culebra Island.

Philornis obscura Van der Wulp was identified by Mr. C. T. Greene from a fly intercepted at Ponce by Mr. R. G. Oakley.

Philornis pica Macquart was identified by Mr. David G. Hall for Dr. H. L. Van Volkenberg (1939–4) who reports "the warble-like larvae are common in the grackle or mozambique, *Holoquiscalus niger brachypterus*, at Mayagüez."

Fannia femoralis (Stein) was identified by Dr. C. H. Curran (1928–89) from Hispaniola, St. Thomas and Santurce, Mayagüez and Ensenada in Puerto Rico.

Fannia pusio Wiedemann was identified by Dr. J. M. Aldrich from San Juan, Puerto Rico; a fly resting on the hedge of "café de la India" (*Chalcas exotica*) around the postoffice building.

Calythea crenata (Bigot), originally described as a *Trichophthicus* from Mexico, was identified with "some doubt" by Dr. C. H. Curran (1928–89) from St. Thomas, and Cayey, Aibonito and Mayagüez in Puerto Rico. He also indicates flies from San Juan as being of the genus *Tetramerinx*.

Neodexiopsis rex, described by Dr. C. H. Curran (1928–88) from a single male from 1,500 feet up on El Yunque, is 4.5 mm. in length, "head, thorax, apical two abdominal segments and the tarsi blackish, elsewhere reddish-yellow."

Fucellia maritima Haliday is cited by Dr. L. O. Howard as *Fucellia fucorum* Fallen in his "A Contribution to the Study of the Fauna of Human Excrement" (Washington Academy of Sciences, **2:** 541–604, illus. Washington, D. C., December 28, 1900) as occurring on Culebra Island having been collected by Mr. Aug. Busck. In his card catalog which is on file in the U. S. National Museum, Dr. J. M. Aldrich wrote "mistake." "This species," according to Dr. Aldrich (1905–564) "is common on seaweeds and other refuse," but can hardly be present in Puerto Rico as it has not since been found here, and most of the records are from Greenland, Alaska and northern Europe.

Scopeumatidae (Cordyluridae or Scatophagidae): Dung Flies

Scopeuma exotica (Wiedemann) was listed by Mr. D. W. Coquillett (1900–257) as *Scatophaga*, collected by Mr. Aug. Busck on Culebra Island. It is not known from Vieques, Puerto Rico or Mona, but the cosmopolitan *Scopeuma stercorarium* (L.) is very common on fresh dung at the higher elevations in Hispaniola. Dr. E. O. Essig (1926–600) describes it as "a slender, pilose, tawny or yellowish brown fly, the males with long pile, very common on cow dung in which the larvae breed. The adults are predaceous on the blow fly and house fly, (being) common in the west."

Sphaeroceridae (Borboridae)

Leptocera angulata (Thomson) was identified by Dr. C. H. Curran (1928–69) from many Puerto Rican localities, from El Yunque to Ensenada, being common in all parts of the Island.

Leptocera discalis (Malloch) occurs in St. Croix, and in many Puerto Rico localities, according to Dr. C. H. Curran (1928–69).

Leptocera fontinalis (Fallén), a European and North American species, was recorded from Puerto Rico by Mr. D. W. Coquillett, having been collected by Mr. Aug. Busck.

Leptocera lugubrina was described by Mr. J. R. Malloch as a *Limosina*

from Puerto Rico in his "Descriptions of New Species of American Flies of the Family Borboridae" (Proc. U. S. National Museum, 44 (1958): 361–372. Washington, D. C., February 20, 1913).

Leptocera sublugubrina Malloch (1912), for *L. lugubris* (Williston) preoccupied, originally described as a *Limosina* from St. Vincent, was collected in Puerto Rico by Mr. Aug. Busck.

Leptocera niveipennis (Malloch) was described as a *Limosina* (1913-361), the type from Peurto Rico.

Leptocera perparva (Williston), described from St. Vincent, occurs in Puerto Rico according to Mr D. W. Coquillett (1900-269).

Leptocera pumilla (Williston) was identified from Puerto Rico by Dr. C. H. Curran (1928-69): specimens from Aibonito and Naguabo.

Leptocera rotundipennis (Malloch) was described (1913–361) as a *Limosina* from Puerto Rico.

Leptocera venalicia (Osten Sacken), supposed to have been introduced from Africa into Cuba by the slave trade, known also from St. Vincent and Brasil, was collected in Puerto Rico by Mr. Aug. Busck, according to Mr. D. W. Coquillett (1900–269), and has since been intercepted at Mayagüez.

Sciomyzidae (Tetanoceridae)

Sepedon caeruleus Mel., as identified by Dr. J. M. Aldrich, occurs in all parts of Puerto Rico, the AMC collection containing specimens from El Yunque, Orocovis, Mayagüez, San Germán and Cartagena Lagoon.

Sepedon macropus Walker, a reddish-yellow fly, its wings clouded with brown, was originally described from Jamaica and occurs also in Cuba. Dr. Gundlach first collected it in Puerto Rico, as identified by Herr Victor von Roeder. Dr. C. H. Curran (1928–86) identified specimens from Caguas, Cayey and Coamo, and in the AMC collection from Río Piedras, Mayagüez and the Cartagena Lagoon.

Lonchaeidae

Lonchaea chalybea Wiedemann, originally described from South America, was first reported from Puerto Rico by Mr. O. W. Barrett (*in* Annual Report P. R. Expt. Station for 1903, pp. 429–450, Office of Experiment Stations, Washington, D. C., 1904) on page 447, as a pest of *Manihot utilissima* and *M. palmata*, and in the following year (1905–396) he mentions the larva as "a serious pest in the tips of cassava canes." For control, handpicking and tobacco dust are recommended. Locally, and in Cuba, this is called "centella de la yuca." Mr. Policarpo González Rios gives an economic account as "El Gusano del Cogollo de la Yuca" (Rev. Agr. P. R., **10** (4): 45–6. San Juan, 1923) of the attack by the maggots of this common, and at times, serious pest. It occurs in all parts of the Island where yuca is planted but is possibly most abundant in the sandy areas. The adults are

little blue-black iridescent flies, with clear wings, sometimes to be seen on the host of the larva, but much less conspicuous than the stunted, gum-exuding, and withering tips which the feeding of the latter cause.

Lonchaea bruneri Malloch, as determined by Mr. C. T. Greene, was originally described from Cuba, reared by Mr. S. C. Bruner from maggots attacking the tips of lima bean vines. This insect is known in Puerto Rico only from material collected by Mr. Pedro Osuna from the same host at La Muda, between Río Piedras and Caguas.

Lonchaea glaberrima Wiedemann was originally described from the West Indies and reported from southern Florida. This name was given by Mr. R. H. Van Zwaluwenburg to specimens he had reared from pods of *Inga vera*, and are P.R. 1664 in his list. They have recently been re-determined by Mr. C. W. Sabrosky as a species of **Carpolo chaea.**

Lonchaea longicornis Williston, originally described from St. Vincent, is reported from Puerto Rico by Mr. D. W. Coquillett (1900–258), having been collected by Mr. Aug. Busck.

Lonchaea nigrocoerulea Malloch was identified by Dr. C. H. Curran from Mayagüez and Tallaboa, Puerto Rico (1928–85), and for Dr. W. A. Hoffman, who collected specimens at light at San Juan. Flies repeatedly intercepted at Mayagüez were identified by Dr. J. M. Aldrich as a new species of *Lonchaea.*

Carpolonchaea pendula Bezzi, as identified by Mr. C. T. Greene, has been repeatedly intercepted in Puerto Rico: reared from orange fruit at San Juan and Mayagüez, reared from lima beans at Isabela and reared from fruit of *Inga laurina* at Jayuya. As identified by Mr. David G. Hall, adults have been collected on Mona Island along the beach by Dr. Luis F. Martorell.

Lauxaniida

Camptoprosopella cincta (Loew), described originally from Cuba as a *Sapromyza*, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. This "shining rusty reddish" fly, 3.0 mm. long, "wings not infuscated; only two pairs of dorso-central bristles," was redescribed by Dr. C. H. Curran (1926–13) as *C. diversa*, from material from Coamo and Arecibo in Puerto Rico, Mona Island and from Fond Parisién and other localities in Haiti. He later (1931–18) recognized its synonymy. Flies intercepted in a grapefruit grove near Añasco are considered by Dr. J. M. Aldrich to be a new species of *Camptoprosopella.*

Physogenua ferruginea (Schiner), originally described as a *Griphoneura* from Costa Rica and known to occur in Mexico, was identified by Dr. J. M. Aldrich from flies swept from grass at Ciales, and later from flies in coffee grove at Lares and intercepted at Loiza.

Physogenua vittata Macquart, originally described from Brasil and known from others of the West Indies, was listed by Drs. Stahl and Gund-

lach as *Lauxania variegata* Loew, as identified by Herr Victor von Roeder. Dr. C. H. Curran (1928–81) identifies this fly from several localities in western Puerto Rico and from specimens in the AMC collection from Matrullas, but it is not localized in distribution, for interceptions have been made at San Juan, and in Isabela Grove at Palo Seco.

Neogriphoneura sordida (Wiedemann), originally described from the West Indies as a *Sapromyza*, and recorded by Mr. D. W. Coquillett from Puerto Rico and the southeastern United States, was identified by Dr. C. H. Curran (1928–82) from the Island of St. Croix of the Virgin Islands, from several localities in Puerto Rico, and from Mona Island. Numerous specimens in the AMC collection from Ponce, Hormigueros, Mayagüez and Río Piedras he also identified as this species.

Pseudogriphoneura albovittata (Loew), originally described as a *Lauxania* from Cuba, and thus identified by Herr Victor von Roeder from the collections made by Dr. Gundlach in Puerto Rico, is recognized by Dr. C. H. Curran (1928–82) by having the "thorax opaque black, with two ashy vittae connected behind by the ashy scutellar margin," specimens from Mayagüez. Others are from Cidra, and these flies have been repeatedly intercepted in grapefruit groves at Mayagüez and Arecibo.

Pseudogriphoneura octopunctata (Wiedemann), described originally as a *Sapromyza* from the West Indies, was thus identified by Herr Victor von Roeder from the material collected by Dr. Gundlach in Puerto Rico. What Dr. C. H. Curran (1931–19) thinks may be this fly was what he described (1926–13) as *Deceia anomala:* "length 2.5 mm.; rusty yellowish, shining, the three or four apical abdominal segments each with a black spot on either side; thorax usually pale yellow, with a black spot on the upper anterior part of the sternopleura; scutellum with a black spot on either side between the marginal bristles."

Pseudogriphoneura vittifacies was described by Dr. C. H. Curran (1931–20), the type from Aibonito, other from Adjuntas, similar to what he had previously reported (1928–83) as *Lauxania cineracea* Coquillett, "but at once distinguished by the presence of two or four shining vittae on the face, and the reddish, more extensively brown-pollinose mesonotum and scutellum; length 4.0 mm." Dr. J. M. Aldrich considers flies intercepted at Cidra as representing a new species of *Pseudogriphoneura*, which may be what Dr. C. H. Curran identified in the AMC collection from Matrullas.

Caliope lutea (Coquillett) is identified with considerable doubt by Dr. C. H. Curran (1928–83); specimens from Arecibo and Aibonito, Puerto Rico. This fly was described from specimens collected in southern Florida as a *Lauxania*.

Caliope scutellata was described by Dr. C. H. Curran (1926–14) from a single specimen from Naguabo, so badly damaged that its sex could not be determined; "similar to *lutea* Coquillett," but "the scutellum bears a large, transverse, apical brownish spot."

Minettia aibonito was described by Dr. C. H. Curran (1926–14): "length 2.0 mm.; pale rusty yellow, the abdomen with three series of small, round brown spots; head and thorax conspicuously cinereous pollinose, the abdomen thinly so." A fly answering to its description has been intercepted at Guayama.

Minettia mona was described by Dr. C. H. Curran (1926–13) from a number of specimens from Mona Island, others from Naguabo and Aibonito, Puerto Rico. It is 3.5 mm. long, "rusty reddish yellow, the head and thorax grayish pollinose; scutellum and abdomen shining; abdomen with three to five series of black spots." The most intensive collecting by Prof. J. A. Ramos did not discover any additional specimens of this fly on Mona Island.

Minettia macula (Loew), described originally from Texas, and thought by Prof. S. W. Williston to be a possible synonym for *Sapromyza octopunctata* Wiedemann, was identified from Puerto Rico (in synonymy with *S. valida* Walker) by Dr. J. M. Aldrich: specimens collected by Mr. E. G. Smyth at Río Piedras in October 1916. Others of "this little brown fly with striped thorax" have been intercepted at Mayagüez, and swept from malojillo at Bayamón.

Minettia picticornis (Coquillett) was identified by Dr. C. H. Curran (1931–20) from two specimens collected by Dr. W. A. Hoffman at Dorado. It is a little yellowish fly, banded and spotted with brown, or, as phrased by Dr. Curran, "the mesonotum bears four black vittae and the abdomen a median row of roundish spots and lateral rows of transverse ones." It has been intercepted in a grapefruit grove at Arecibo, as identified by Dr. J. M. Aldrich, and most recently collected at Río Piedras, resting on concrete column, as identified by Mr. C. W. Sabrosky.

Minettia slossonae (Coquillett), originally described as a *Sapromyza* from Biscayne Bay, Florida, is apparently one of the most abundant of these flies in Puerto Rico, Dr. C. H. Curran (1928–84) identifying it from the Virgin Islands of St. Croix and St. Thomas, from various localities in Puerto Rico and from Mona Island. He states that "Malloch considers this to be only a variety of *octopuncta* Wiedemann (*octopunctata* auct.)." Specimens identified as this species by Dr. J. M. Aldrich have been intercepted at Mayagüez, swept from malojillo at Bayamón and in an orange grove at Pueblo Viejo.

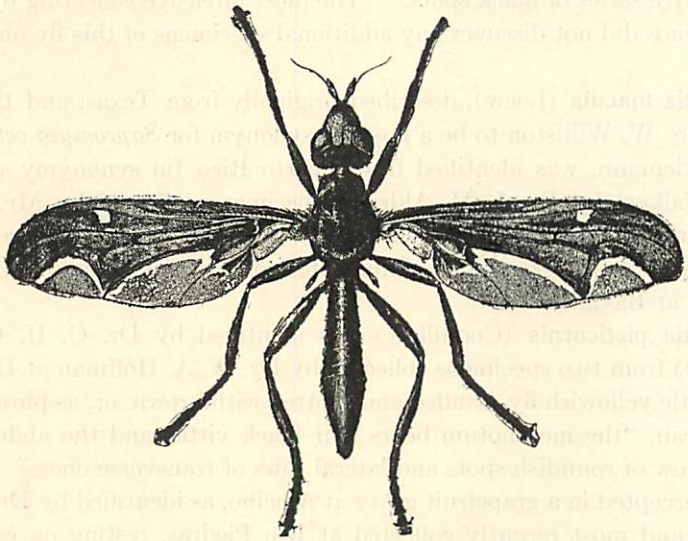
Minettia sororia (Williston), originally described as a *Sapromyza* from St. Vincent, was identified by Dr. C. H. Curran (1928–85) from Puerto Rico: a single specimen from Aibonito.

Trigonmetopus angustipennis Knab was the identification by Dr. J. M. Aldrich of flies intercepted by Mr. R. G. Oakley, resting on pomarrosa at Cidra, and in the mountains back of Yauco. To specimens previously

submitted which had been collected in abandoned coffee groves at Indiera, he had given the identification of "sp. nov." in this genus. *T. rotundicornis* Williston was described from St. Vincent. Dr. C. H. Curran identifies flies in the AMC collection from Matrullas as **Trigonmetopus vittatus** Loew, a species originally described from Georgia.

Otitidae (Ortalidae)

"*Pyrgota undata* Wiedemann is a fly of extraordinary appearance and habits, the females of which lay eggs in (May) beetles, attacking them when



Pyrgota undata Wiedemann, a continental Otitid fly which is parasitic on May Beetles, three times natural size. (After Davis.)

they are flying by night, and the ovipositor can be inserted though the unprotected tender skin of the upper part of the abdomen." As related in an early account of "Insect Parasite Introduction in Porto Rico" (Jour. Dept. Agr. P. R., 6 (1): 5–20, fig. 7. San Juan, October 1922), "in some years, large numbers of *Lachnosterna* beetles in Illinois are parasitized, but during the summers of 1913 and 1914, when many beetles were collected, this fly was comparatively rare, and only an occasional parasitized beetle was found. Several fly puparia inside dead beetles were collected in plowed fields and sent to Puerto Rico, but no adults emerged."

Xanthacrona bipustulata Van der Wulp, originally described from Mexico, was identified by Dr. C. H. Curran (1928–77) from Jamaica, and from Puerto Rico a single specimen from Coamo.

Acrosticta apicalis (Williston), originally described as an *Euxesta* from St. Vincent, was listed by Mr. D. W. Coquillett (1900–258) from Puerto Rico, specimens having been collected by Mr. Aug. Busck. It is an iridescent blue-black fly, with clear wings except for the front margin and apex, repeatedly collected since, as identified by Dr. J. M. Aldrich, in the more humid parts of the Island: attracted to rotting fruit, such as grapefruit and over-ripe hog-plums or "jobo" (*Spondias mombin*), and to the exuding juices on corn leaves.

Acrosticta foeveolata Loew is identified by Dr. C. H. Curran (1928–77) from many localities in the more humid section of Puerto Rico, and from the Island of St. Thomas.

Acrosticta pallipes Grims., as determined by Mr. C. T. Greene, was quite abundant in the Isabela ginnery in August 1945, and numerous dead flies were collected from the window-sills and floor after it has been sprayed with DDT.

Euxesta abdominalis Loew, originally described from Cuba, is one of the most common of this genus in Puerto Rico, if one may judge by the number of north coast localities from which Dr. C. H. Curran (1928–79) identified specimens, including Mona Island. The "base of the abdomen (is) usually reddish" in this otherwise blue-black iridescent fly.

Euxesta annonae (Fabricius), originally described as a *Musca* from the West Indies, was first reported from the collections of Dr. Gundlach in Puerto Rico by Herr Victor von Roeder, and Mr. F. Knab identified specimens collected at Mayagüez for Mr. R. H. Van Zwaluwenburg. Dr. C. H. Curran (1928–79) lists specimens from the Virgin Islands of St. Croix and St. Thomas, from many mountainous localities in Puerto Rico as well as San Juan, Arecibo, Mayagüez and Ensenada, and from Mona Island. On Vieques Island, Dr. M. D. Leonard and Prof. Wm. T. M. Forbes collected this fly, as identified by Dr. Curran (1931–17).

Euxesta costalis (Fabricius), originally described as a *Musca* from the West Indies, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. Dr. C. H. Curran (1928–78) reports it only from the Virgin Islands of St. John and St. Thomas.

Euxesta eluta Loew, originally described from Cuba, is identified by Dr. C. H. Curran (1928–78) for specimens from Naguabo to Ensenada, and intermediate points in Puerto Rico. It has been reared from maggots intercepted in silk of sweet corn at Mayagüez.

Euxesta mitis was described by Dr. C. H. Curran (1931–17) from two females collected by Prof. W. T. M. Forbes on Vieques Island. It is "a very small species, 2.25 to 2.4 mm. long, with three brownish-black spots on the wings (as illustrated), and a very prominent clypeus."

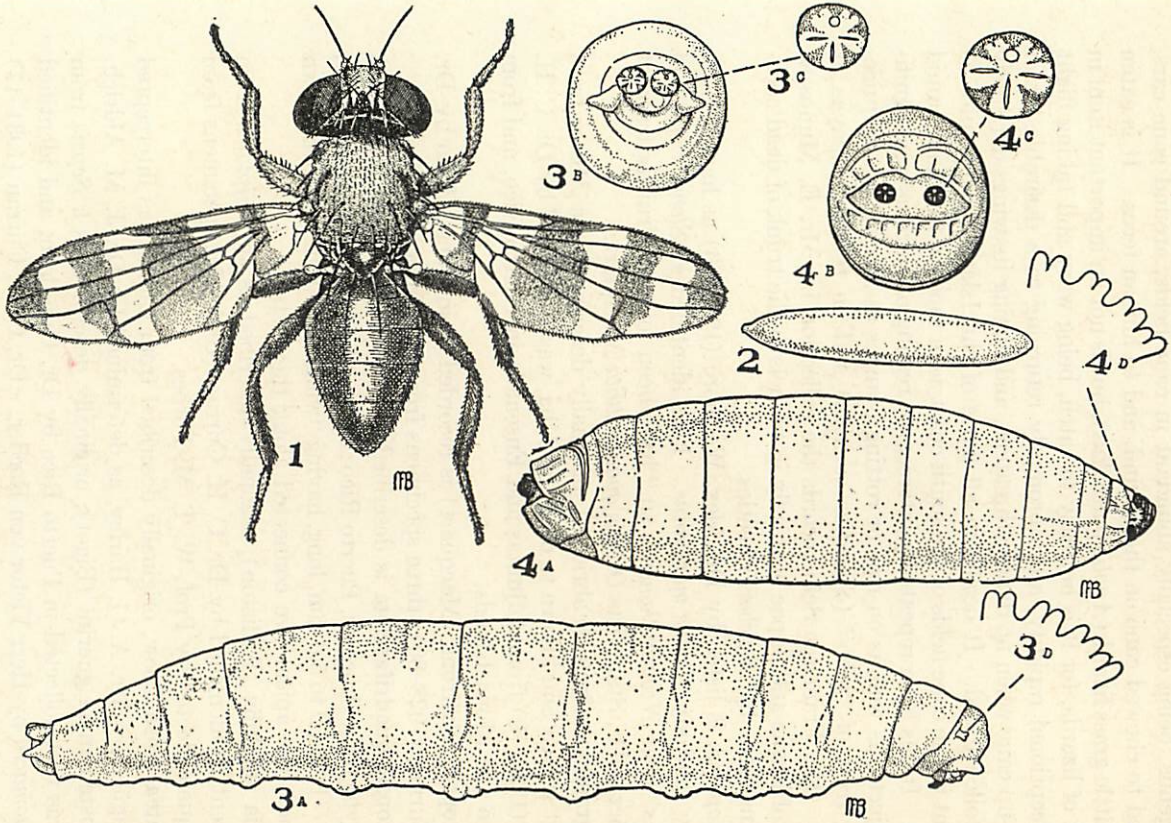
Euxesta notata (Wiedemann), originally described as an *Ortalis* from

Savannah, Georgia and New York, occurs thruout the eastern United States, the larvae having been found in sumac fruit in Virginia, cotton bolls in Alabama, onions in New Jersey and the pulp of Osage orange (*Maclura* or *Toxylon pomifera*). On February 1, 1926, Mr. Francisco Seín collected ten of these flies "running over half rotten oranges dumped out doors in Mayagüez. The flies laid eggs on the sides of the moist vial in which they were kept. The eggs hatched in three days, and the larvae (cream-colored with two dots on the hind end) were fed on pieces of orange placed inside the vial. Some continued their development on the orange tissues after they had rotted. They pupated in soil placed in the tubes and on the cloth which closed the opening. Flies emerged twenty-three days after the eggs hatched, or 26 days from egg to adult. (Later) this fly was observed walking over fruits at a picnic in a coconut grove at Loiza." These flies have also been intercepted on over-ripe fruits of "jobo" (*Spondias mombin*) in the metropolitan area and at Dorado. Messrs. Richard Faxon and C. P. Trotter, discussing their experiences with the "Plant Quarantine Service in Porto Rico" (Jour. Ec. Ent., **25** (3): 435–447. Geneva, June 1932), state that "the spotted root fly, *Euxesta notata* Wied., has been taken many times from oranges and less frequently from grapefruit. It has not been proved how this insect gains entrance to the fruit, but it seems probable that the infestation is secondary."

Euxesta spoliata Loew, originally described from Cuba, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder, and was listed by Mr. D. W. Coquillett (1900–258) as having been collected by Mr. Aug. Busck. Dr. C. H. Curran (1928–78) has identified it from the Island of St. Croix and from several localities in Puerto Rico, and it has been intercepted in an orange grove at Mayagüez.

Euxesta stigmatias Loew, originally described from Cuba and Brasil, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. Dr. C. H. Curran determined specimens from the Island of St. Croix (1928–78), from several localities in Puerto Rico, and from Mona Island. It had been repeatedly intercepted, and once reared from rotten corn before Mr. B. A. App reported on the habits of the maggots of "*Euxesta stigmatias* Loew, an Otitid fly infesting ear corn in Puerto Rico" (Jour. Agr. Univ. P. R., **22** (2): 181–188. Río Piedras, May 1938). He found it a serious pest of sweet corn being grown experimentally. In the Annual Reports of the Experiment Station at Mayagüez for 1939 to 1941 the practical means of control by spraying with pyrethrum, or treating with mineral oil as for corn earworm, are discussed.

Euxesta thomae Loew, originally described from St. Thomas, and listed from Puerto Rico by Mr. D. W. Coquillett (1900–257) as collected by Mr. Aug. Busck, is not recognized by Dr. C. H. Curran. It has been repeatedly



The Corn Ear Otitid Fly, *Euxesta stigmatias* Loew: 1, adult, about twelve times natural size, 2, egg, 3A, lateral aspect of larva, 3B posterior aspect of larva, 3C, posterior spiracle, 3D, anterior spiracle, 4A, lateral aspect of puparium, 4B, posterior aspect of puparium, 4C, posterior spiracle, 4D, anterior spiracle. (Drawn by Mrs. Mary Foley Benson.)

identified by Dr. J. M. Aldrich, and presumably is one of the most common of the genus, being especially abundant in cane fields, around cane cars, attracted to chewed cane on the ground, and to human feces. It is eaten by the little grass lizard (*Anolis pulchellus*), but is not an important item in the diet of lizards, for it is not easy to catch, being wary and taking flight with exceptional rapidity, altho promptly returning to a desirable bit of chewed-up cane when no danger threatens, and flirting its wings derisively at the foiled lizard. It occurs in all parts of the Island, being quite as abundant in the cane fields of the south coast as in those of the more humid regions. It has been repeatedly intercepted resting on various non-significant objects, as well as on ripe or rotting oranges at Mayagüez, on juice-exuding fruit of "jobo" (*Spondias mombin*) and on rotting papayas at Isabela. Mr. Francisco Seín records the collection by Mr. E. Muños at Camuy of larvae and pupae of this fly in tunnels in the trunk of dead coconut palms made by *Xyleborus* beetles.

Tetanops sp. is listed by Dr. Alex. Wetmore (1916–66) as having been eaten by the tody, *Todus mexicanus*. Flies identified as *Stenops* sp., and others as "near *Neoacanthoneura* sp." have been found in fruitfly traps at Mayagüez. Dr. Stahl lists *Ortalis quadrivittata* Macquart.

Notogramma stigma (Fabricius), originally described as a *Musca* from the West Indies, and known to occur in Cuba, was recognized by Dr. C. H. Curran (1928–79) from Adjuntas and Ensenada in Puerto Rico, and from Desecheo and Mona Islands.

Chaetopsis fulvifrons (Macquart) is recorded from Puerto Rico by Dr. C. H. Curran (1928–80): three specimens from San Juan.

Chaetopsis quadrifasciata is described by Dr. C. H. Curran (1928–80) from a type from Orocovis, Puerto Rico; others from San Juan and Miami, Florida. It is 4.0 to 5.0 mm. long, having "wings with four blackish-brown crossbands, the apical two connected along the costa."

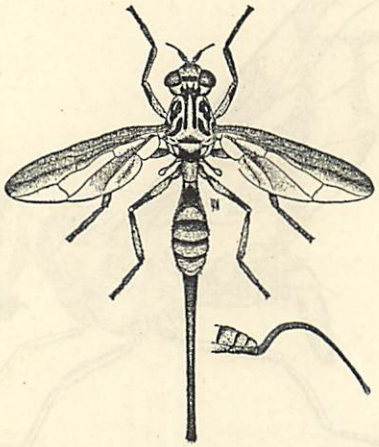
Setellia amabilis (Williston), originally described as an *Epiplatea* from St. Vincent, is identified by Dr. C. H. Curran (1931–17): specimens from El Yunque collected by Prof. W. T. M. Forbes.

Epiplatea erosa Loew, originally described from Cuba, was intercepted at Mayagüez by Mr. A. G. Harley, as determined by Dr. J. M. Aldrich.

Macrostenomyia guerini (Bigot), originally described as a *Sepsis* from Cuba, was first collected in Puerto Rico by Dr. Gundlach, and identified as a *Stenomacra* by Herr Victor von Roeder. Dr. C. H. Curran (1931–17) identified as this species a pair collected by Dr. M. D. Leonard at Cidra, and another pair collected by Prof. W. T. M. Forbes at Coamo. As identified by Dr. J. M. Aldrich it has been intercepted in an orange grove at Ponce by Mr. R. G. Oakley, in fruitfly trap at Mayagüez, and at Maricao.

Tephritidae (Trypetidae): Fruitflies

Toxotrypana curvicauda Gerstaecker, originally described from the "Island of St. Jean of the Danish West Indies," now called St. John of the U. S. Virgin Islands, is known also from tropical South and Central America, Yucatan in Mexico, southern Florida, Cuba, Hispaniola and the Bahama Islands. It was first reported from Puerto Rico by Dr. C. W. Hooker (*in* Ann. Rpt. P. R. Expt. Station for 1912, pp. 34-38. Washington, D. C., July 26, 1913) as "abundant at Mayagüez. The eggs are laid well below the surface of the green fruit of papaya (*Carica papaya*); 2 to 15 or more larvae within the fruit, and when it drops, pupate 1 or 2 inches below the surface of the ground below the fruit. Adults emerge in 17 to 21 days, and eggs for another brood are soon laid." The "Papaya Fruit Fly'

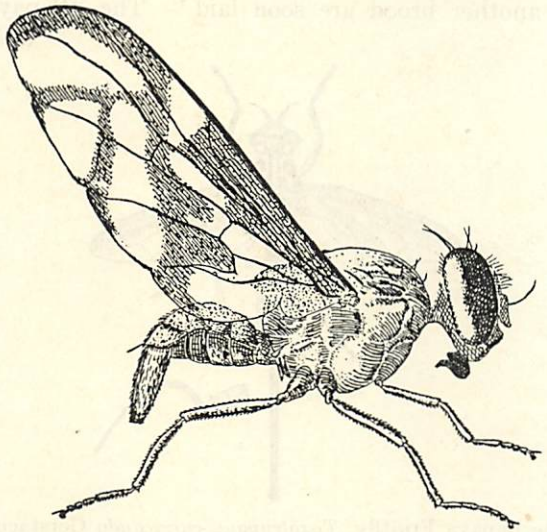


Female of the Papaya Fruitfly, *Toxotrypana curvicauda* Gerstaecker, two and a half times natural size. Lateral view of ovipositor below. (Drawn by L. Pierre-Noël.)

(Jour. Agr. Research, 11 (6): 447–457, pl. 2. Washington, D. C., September 21, 1914) was intensively studied by Messrs. Frederick Knab and W. W. Yothers in Florida, who observed "that fruit with very thick meat escapes infestation. While the papaya fruit fly attempts to oviposit on such fruit, the thickness of the meat prevents the tip of the ovipositor from reaching the seed cavity, and in the meat itself the larvae cannot live." Instances have been noted in Puerto Rico, however, of a thick-fruited variety, of which the seed was reported to have come from Africa, heavily infested at Cupey, above Río Piedras. Thin-fleshed fruit has also been found infested at Bayamón and at Guayama, but heaviest infestations have invariably been in the western end of the Island, primarily at Mayagüez,

as noted by Mr. W. V. Tower and in Van Zwaluwenburg's list (1243), and at Isabela, to which Dr. M. D. Leonard & Mr. Francisco Seín, writing of "The Papaya Fruit Fly in Puerto Rico," (Jour. Ec. Ent, **24** (1): 331–2. Geneva, February 1931) add Lares, and Messrs. Richard Faxon and C. P. Trotter (1932–446) add Ponce. At Mayagüez also, in the 1938 Report of the P. R. Experiment Station (1939–100), parasitizm by *Dirhinus giffardi* Silvestri is reported.

Anastrepha edentata (=*Anastrepha* sp. "F" of Plant Commissioner Arthur C. Brown *in* Florida State Plant Board Biennial Report, **11**: 20–21. Gainesville, 1937) was described by Dr. Alan Stone as one of new species of "The Fruitflies of the Genus *Anastrepha*" (U. S. D. A. Misc. Pub-



The Jobo Fruitfly, *Anastrepha mombinpraeoptans* Seín, eight times natural size. (Drawn by Fritz Maximilien.)

lication No. 439, pp. 112, pl. 23, fig. 22, ref 10. Washington, D. C., January 1942), "small and yellow brown," the type from Key Largo, Florida, others from Mayagüez, P. R., collected in trap, "taken every month in the year on the Florida Keys, but the host has not been discovered."

Anastrepha mombinpraeoptans was described by Mr. Francisco Seín as a variety of *A. fraterculus* Wiedemann in his study of "*Anastrepha* (Trypetidae, Diptera) Fruit Flies in Puerto Rico" (Jour. Agr. P. R., **17** (3): 183–196, pl. 5, ref. 11. San Juan, November 14, 1933), the type from Rio Piedras, reared from fruit of "jobo" (*Spondias mombin*), others from fruit of "ciruela" (*Spondias cirouella* and *S. purpurea*), the fruit of some varieties of mango (*Mangifera indica*), rarely in fruit of "jobo de la India"

(*Spondias dulcis*), occasionally in fruit of guava (*Psidium guajava*) or "pomarrosa" (*Eugenia jambos*). "The egg is inserted in the fruit up to the shoulder, the head and neck protruding outside the cuticle" of the fruit. This is the common frutifly of the West Indies, first reported from Puerto Rico by Dr. Gundlach as *Acrotoxa fraterculus* Wiedemann, as determined by Herr Victor von Roeder. Mentioned by Mr. D. L. Van Dine as one of the important "Mango Insects in Porto Rico" (First Ann. Rpt. P. R. Hort. Soc. for 1912, pp. 20–22. San Juan, 1912), it was more extensively discussed by Mr. W. V. Tower (1912–34 to 35) as *A. acidusa* Walker, attacking the fruit of imported mangoes, especially the Cambodiana variety. Mr. C. F. Kinman, writing of "The Mango in Porto Rico" (P. R. Expt. Station, Bulletin No. 24, pp. 30, pl. 11. Washington, D. C., 1918) recommended enclosing ripening fruits in individual paper bags to prevent infestation. Dr. C. W. Hooker (1913–36) using the name *Anastrepha fraterculus* Wiedemann, "closely related to *A. acidusa*" as determined by Mario Bezzi, notes that this jobo fruitfly may also attack one native variety of mango: mango de puerco, and that the maggots in jobo fruits are parasitized by *Opius* (*Utetes*) *anastrephae* sp. nov. Viereck and *Ganaspis* sp. nov., which Mr. J. C. Crawford later described as *hookeri*.

The hearing held by the Federal Horticultural Board to consider the advisability of restricting or prohibiting the entry from Porto Rico of fruits and vegetables into the Unites States (Jour. Dept. Agr. P. R., **8** (1): 5–46, pl. 1. San Juan, August 1925) was, to a very considerable extent, due to this fruitfly, and the uncertainty as to its exact distribution and status. It was shortly thereafter that Mr. Francisco Seín commenced his investigations which eventually indicated morphological and physiological differences separating it from what he described as *Anastrepha unipuncta*, maggots of which had been found in ripe grapefruit and other citrus fruits. "Heat Sterilization of Mangoes and Guavas for Fruit Flies" (Jour. Agr. Univ. P. R., **19** (2): 105–115, ref. 3. Río Piedras, September 1935) "at a temperature of 43°C. for eight hours (with a minimum of four hours for complete effectiveness) in a circulating atmosphere saturated with moisture kills the eggs, maggots and pupae of the fruit flies that infest mangoes and guavas in Puerto Rico without unfavorably affecting the flavor, appearance or keeping qualities of the fruit if it is afterwards placed in refrigeration" was shown by his experiments. "A Revision of the Genus *Anastrepha* based on a Study of the Wings and on the Length of the Ovipositor Sheath (Diptera: Trypetidae)" (Proc. Ent. Soc. Washington, **36** (6): 127–179, pl. 5, ref. 36. Washington, D. C., July 9, 1934) by Mr. C. T. Greene, showed, however, that besides occurring in all of the Greater Antilles, many of the Lesser Antilles, Canal Zone, Central America and Mexico, this species also occurred in south Texas and at Key West, Florida. Dr. A. da Costa

Lima in "Moscas de Frutas do Genero *Anastrepha* Schiner 1868 (Diptera: Trypetidae)" (Instituto Oswaldo Cruz Mem. **28,** pp. 487–575, illus. Río de Janeiro, 1934) extends the distribution of "The West Indian Fruit Fly" to include Río de Janeiro, and Dr. Alan Stone (1942–68) by synonymy to include Trinidad, Venezuela and Ecuador, stating that it "occurs only rarely in *Citrus*, a few infestations having been found in grapefruit in Puerto Rico." Indeed, "A Study of the Adult Populations of the West Indian Fruitfly in Citrus Plantings in Puerto Rico" (P. R. Expt. Station Bulletin No. 41, pp. 16, ref. 9, fig. 1. Washington, D. C., December 1941) by Mr. L. C. McAlister Jr., Dr. W. A. McCubbin and Messrs. G. A. Pfaffman, W. T. Owrey, H. G. Taylor and I. W. Berryhill, indicated that "*Anastrepha mombinpraeoptans* has not been a citrus-breeding fruitfly under normal conditions in Puerto Rico."

Anastrepha suspensa (Loew), originally described from Cuba as an *Acrotoxa*, was re-described by Mr. Francisco Seín under the name *Anastrepha unipuncta*, the type from Río Piedras (1933–190), reared from maggots infesting guava (*Psidium guajava*), others from "pomarrosa" (*Eugenia jambos*) and the husks of "almendra" (*Terminalia catappa*); the fruits of "caimito" (*Chrysophyllum cainito*), "nispero" (*Sapota achras*), and "corazon" (*Annona reticulata*); more rarely, the fruit of kumquat (*Fortunella margarita*), sour orange, native and Valencia orange and grapefruit sporadically in the late spring and early summer. He differentiates it from *mombinpraeoptans* "by the dark spot on the suture between the metathorax (mesonotum) and the scutellum. The egg has no neck and is deposited entirely underneath the cuticle of the fruit." When the studies by Mr. C. T. Greene (1934–132) made identification certain, it was found that specimens in the U. S. National Museum had been collected in southern Florida. Dr. Alan Stone (1942–74) records occurrence in Hispaniola, and considers the *Anastrepha longimaculata* described by Mr. Greene (1934–146) from Jamaica a synonym, or at most a local race, of *Anastrepha suspensa*. Normally in Puerto Rico the females of this fruitfly oviposit in the fruits of guava and pomarrosa, and to a lesser extent in the husks of the tropical almond. Presumably it was this fly which is reported by Mr. R. H. Van Zwaluwenburg (1918–34) under the name of *Anastrepha fraterculus* in pomarrosa fruits at Maricao in July 1917. Its attack on economic hosts developed at a time when citrus fruit from the Río Grande valley in south Texas first began to come on the continental market in competition with grapefruit from Puerto Rico. The most unexpected low prices for early fruit caused practically all growers to attempt to keep their fruit on the trees as long as possible, rather than pick it while still green and ship to an expectant New York market in which previously they had experienced no competition. Such an unusual and enormous amount of dead-ripe

grapefruit presented an opportunity for infestation by this fruitfly which resulted in some fruit being attacked, with appreciable commercial injury in some few groves bordered by mango or pomarrosa trees. "Although *Anastrepha suspensa* has not been known to breed in mango fruits in Puerto Rico," it has "a peculiar habit of migrating over large areas into various trees, including mango and citrus," according to Mr. L. C. McAlister, Jr., Dr. W. A. McCubbin and others (1941–10). They conclude that "the quantity or number of citrus fruits with larval infestation has been entirely negligible from the commercial viewpoint." As this species of fruitfly also occurs in southern Florida, from the quarantine standpoint it could not legitmately be considered a menace to the citrus industry in other parts of the United States, to which it undoubtedly would have spread long ago had conditions there been suitable for its continued existence.

Xanthaciura insecta (Loew), originally described as a *Trypeta* from Cuba, and known to occur in the other Greater Antilles, was first collected in Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder. In cane fields on the north and west coasts it is often noted resting on the leaves of young ratoons: conspicuous, despite its small size, because of the brownish pictured wings, out of which narrow, clear triangular areas appear to be cut. Dr. C. H. Curran (1928–71) records it as an *Aciura* from San Juan to Mayagüez, and the mountains at Orocovis. Interceptions have been made at Naguabo. Prof. James G. Needham found it a common and important member of "An Insect Community which Lives in Flower Heads" of shepherd's needles (*Bidens pilosa*) in Florida (National Geographic Magazine, **90** (3): 340–356. Washington, D. C., September 1946), naming it the Bandwing. "This dainty little black-backed fly has big green eyes, drooping yellow antennae, and a row of stiff white bristles set across the rear of its head like a back comb. Its under parts and legs are clear yellow. Gleaming, resplendent wings are like banners, black from base to tip, with large transparent triangles of glassy clearness cut out of both front and rear margins. This fly behaves as if quite conscious of the elegance of its dress. It struts this way and that, making little vacillating turns, then stands momentarily flirting its wings, turning each like a fan, in a manner that recalls the actions of a girl model displaying the latest styles in a fashion show." The eggs are laid in the flowers, the maggots develop in the green seeds, sometimes four or five in a single head, the pupae being formed in the cavity left by the feeding of the larvae, and adults emerging seven days later.

Xanthaciura phoenicura (Loew), originally described as an *Aciura* from Brasil, and recorded from St. Vincent, was identified by Dr. J. M. Aldrich from interceptions in the metropolitan area, and resting on grass at Añasco.

Ensina humilis (Loew), originally described as a *Trypeta* from Cuba,

and known to occur in Jamaica, southern Florida and Mexico, was first identified from Puerto Rico by Herr Victor von Roeder: material collected by Dr. Gundlach. A little, light brown fly, with rounded clear areas in its pictured wings, it is not so common on the leaves of young ratoon cane along the north coast as it is in the lower hills of the interior, as at Corozal, Ciales and San Sebastián, where it is so abundant as to form an item in the food of the little grass lizard, *Anolis pulchellus*. It was intercepted in a grapefruit grove at Mayagüez by Mr. A. G. Harley. Dr. C. H. Curran (1928–70) lists it from many mountain localities under the name of *Ensina picciola* (Bigot), and Dr. Alan Stone now calls it **Paroxyna picciola** (Bigot).

Ensina peregrina Loew, described originally from Brasil, was listed from Puerto Rico as a *Tephritis* by Mr. D. W. Coquillett (1900–258), having been collected here by Mr. Aug. Busck.

Acrotænia testudinea Loew, originally described from Cuba, has been repeatedly intercepted in Puerto Rico, as identified by Mr. C. T. Greene, from Trujillo Alto, Bayamón, Orocovis, Arecibo and Rincón.

Trupanea dacetoptera Phillips, listed by Dr. C. H. Curran (1928–71) from the Island of St. Croix, was identified by him from Boquerón, specimens in the AMC collection. The same specimens, or others collected at Boquerón at the same time, were identified by Dr. J. M. Aldrich as *Trypanea daphne* Wiedemann, and others from Mayagüez. At Orlando, Florida, larvae mining in *Gnaphthalium obtusifolium* proved to be the immature stages of this fly.

Trupanea mevarna (Walker), originally described as a *Trypeta* from Florida, but occurring widely in the United States and Mexico, is listed by Dr. C. H. Curran only from Adjuntas. It is really quite common, Dr. J. M. Aldrich identifying as *Urellia solaris* Loew numerous specimens swept from malojillo at Pt. Cangrejos and found resting on young ratoon cane at San Sebastián. It is a little grey fly, with a single large brown blotch on the wing, from which splashes radiate to the edges. In Florida, the larvae of this fly have been found feeding in the flowers and tender tips of *Chrysopsis*.

Dyseuaresta melanogaster (Loew), described originally from Cuba as an *Euaresta*, was thus identified from Dr. Gundlach's collections in Puerto Rico by Herr Victor von Roeder. Dr. C. H. Curran (1928–73) lists "very many specimens from numerous localities in Porto Rico and adjacent islands," but it was subsequently intercepted only once in an orange grove at Maricao. It is a little grey fly with most of its wing brown, the "marginal cell with three hyaline spots," found most often on grass or low vegetation in grapefruit, orange or coffee groves back from the coast, in the lower hills of the interior.

Dyseuaresta mexicana (Wiedemann), listed as an *Euaresta* by Van Zwaluwenburg (P. R. 106), was "not seen" by Dr. C. H. Curran (1931–15), nor has it since been collected in Puerto Rico.

Dyseuaresta plesia was described by Dr. C. H. Curran (1928–71) as an *Euaresta* from a single headless female from Coamo, with wings of which the "marginal cell (has but) two hyaline spots," as shown by his accompanying illustration. Dr. Alan Stone considers this and *melanogaster* synonyms of *mexicana*.

Tetreuaresta obscuriventris (Loew) was identified by Dr. C. H. Curran (1928–73) from several Puerto Rican localities, and in the AMC collection from Cidra, Maricao and Las Marias. As identified by Mr. C. T. Greene, it has been collected by Dr. Luis F. Martorell on Mona Island.

Plagiotoma pura was described by Dr. C. H. Curran (1931–16) from a single male collected by Dr. W. A. Hoffman at Jájome Alto, "similar to *discolor* Loew (of Cuba) except that the abdomen is shining rusty-reddish with black lateral spots; length 4.0 mm." Dr. Stone places it in the genus **Tomoplagia.**

Blepharoneura fulvicollis Van der Wulp, described originally from Mexico, has been intercepted at Ponce by Mr. R. G. Oakley, as identified by Mr. C. T. Greene.

Tylidae (Micropezidae or Calobatidae)

Nerius cinereus was described by Herr Victor von Roeder (1885–348) from material collected in Puerto Rico by Dr. Gundlach, but has not since been found.

Micropeza limbata was described by Herr Victor von Roeder (1885–347) from flies collected by Dr. Gundlach in Puerto Rico, presumably at or near Mayagüez. Dr. C. H. Curran (1928–85) lists specimens, identified by Mr. E. T. Cresson, Jr., from Mayagüez to Adjuntas, and later determined others (1931–21) from Cidra and Maricao, and in the AMC collection from Las Marias. This fly was intercepted on flowers of orange at Adjuntas by Mr. R. G. Oakley.

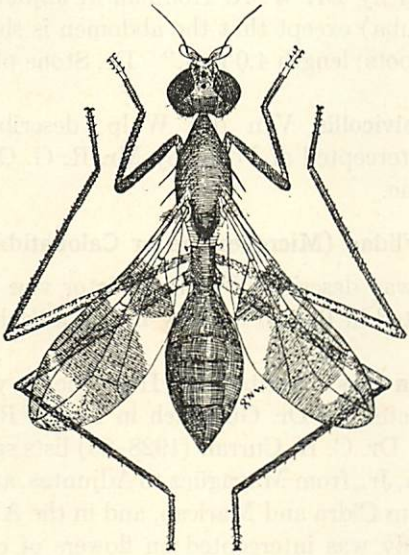
Systellapha scurra Enderlein has a chestnut-red head and thorax, black abdomen, wings clear except for distal angle and medio-distal quarter, and is often to be found in coffee groves in the mountains, as noted in "Insectae Portoricensis" (1923–230). Indeed, it is sufficiently common to form an item in the food of the crested lizard, *Anolis cristatellus*. Dr. C. H. Curran (1928–85) identifies it from Mayagüez and from other localities in the mountains, and (1931–21) from El Yunque, where it was collected by Prof. Wm. T. M. Forbes. It has also been intercepted on El Yunque, on orange flowers at Adjuntas and at Mayagüez.

Hoplocheiloma fasciata (Fabricius), to use the new name suggested by Mr. E. T. Cresson, Jr. (Trans. Amer. Ent. Soc., **52** (3): 249–274 (see p. 272). Philadelphia, 1926) for what was originally described as a *Musca* from the West Indies, was recorded from Puerto Rico by Mr. D. W. Coquillett (1900–257), having been collected by Mr. Aug. Busck, "on human excrement" as noted by Dr. L. O. Howard. Under the name *Calobata*,

as identified by Herr Victor von Roeder, Dr. Gundlach lists this fly as "común," and Dr. Stahl in his list calls it a *Taeniptera*. Dr. C. H. Curran (1928–85) identified a single specimen from Fajardo, and in the AMC collection, specimens from Mayagüez.

Calobata munda Van der Wulp, as identified by Mr. C. T. Greene, was intercepted resting on a grapefruit leaf at Añasco.

Taeniaptera lasciva (Fabricius), originally described as a *Musca* from Cayenne (French Guiana), repeatedly noted from Cuba as a *Calobata*, and found as far north as Philadelphia and southern New Jersey, was first



The Calobatid fly, *Taeniaptera lasciva* (Fabricius), six times natural size. (Drawn by G. N. Wolcott.)

recorded from Puerto Rico by Dr. Gundlach, as identified by Herr Victor von Roeder as a *Calobata*. Dr. Stahl lists it as a *Taeniaptera*, and this is the generic name used by Dr. C. H. Curran (1928–85) for his determinations, from Fajardo to Mayagüez. It is a common and very conspicuous fly in fields of young cane, with its long legs, white front feet and pictured wings. Larvae found in decayed cane cuttings and in dead, dry cane stalks, have been reared to adult. Despite the rapidity with which adults take flight when alarmed, they have been caught by the crested lizard, *Anolis cristalleus*, and form a minor item in its food. Sometimes adults are seen on cane leaves which do not take flight, and upon examinition it will be found that they have been killed by a fungus disease, and are so fragile

that insufficient material for identification of the fungus can not be collected even with the greatest of care. The flies have been intercepted on numerous other non-significant hosts than sugar-cane leaves, from numerous north coast points, and in smaller numbers are to be found on the south coast, as at Guayanilla. Indeed, one epidemic of the fungus disease occurred at Guayanilla in December 1938, the only other observed being at Canovanas in November 1936.

Clusiidae

Sobarocephala bivittata Melander and Argo, originally described from Costa Rica, has been identified by Dr. C. H. Curran (1931–22) from a pair collected by Dr. W. A. Hoffman at Dorado, both of which have the "scutellum wholly yellowish."

Sepsidae

Sepsis armata Schiner is identified by Dr. C. H. Curran (1928–74) from Aibonito, Adjuntas and Mayagüez. It, and the more abundant *S. pusio*, have been intercepted on cotton plants at Río Piedras.

Sepsis armillata Melander and Spuler is identified by Dr. C. H. Curran (1928–76) from many localities in Puerto Rico from Naguabo to Mayagüez.

Sepsis discolor Bigot, originally described from Cuba, was identified by Herr Victor von Roeder from material collected in Puerto Rico by Dr. Gundlach.

Sepsis furcata Melander and Spuler is doubtfully identified by Dr. C. H. Curran (1928–75) from Mayagüez and Arecibo.

Sepsis haemorrhoidalis Schiner is identified by Dr. C. H. Curran (1928–74) from localities in Puerto Rico from Naguabo to Mayaguez.

Sepsis pusio Schiner, first reported from Puerto Rico by Mr. D. W. Coquillett (1900–259) as *Sepsis insularis* Williston, is apparently the most "common and widely distributed species" of the genus, being identified by Dr. C. H. Curran (1928–76) from the U. S. Virgin Islands of St. Croix and St. Thomas, from many localities in Puerto Rico, and from Mona Island.

Sepsis simplex was described by Dr. C. H. Curran (1928–75) from a pair from Adjuntas, others from Arecibo and Naguabo (around horse manure).

Ephydridae

Ephydra gracilis Packard, as determined by Mr. David G. Hall, is one of "Two Insects New to Puerto Rico" (Jour. Agr. Univ. P. R., **21** (4): 535–8. Río Piedras, November 1937) now occurring in great abundance at the margins of the salt lagoons from Faro de Cabo Rojo to Parguera and Guánica, with larvae and pupae present in the concentrated salt water.

According to Mr. C. F. W. Muesebeck, "minor differences in color between the Puerto Rican specimens and those from the continent have been noted by Mr. Hall, but he found the male genitalia to match exactly, and believes that only a single species is involved." Dr. Stuart T. Danforth collected this fly as far back as 1926, but Dr. Aldrich and Dr. Curran identified his specimens only to genus. It was not noted by Mr. R. H. Van Zwaluwenburg at the time he was Entomologist at the Mayagüez Station, "and the great swarms of flies are so noticeable that it is hardly likely they would have escaped his observation if present here at that time." Dr. E. O. Essig (1926–608) notes that the fly is "2.3 to 3.5 mm. long, opaque grey, paler beneath and a slight green tinge above, and bright green legs marked with yellow. The larvae are somewhat transparent white, have eight pairs of long prolegs, and live suspended everywhere in the open water of Great Salt Lake, Utah, and Salton Sea, in salt water at San Francisco and adjacent to the Pacific Ocean at Laguna Beach, California. The fly was introduced from Great Salt Lake into San Francisco Bay by railroad trains after the building of the cut-off at the Lake, as described by Dr. J. M. Aldrich (Psyche, **25:** 30, 1918)." How the fly was carried from California to Puerto Rico in sufficient numbers to become established here is an unsolved problem. It has recently been noted by Mr. Otto H. Swezey as one of the "Insect Invaders in Hawaii during and since World War II" (Journal of Economic Entomology, **41** (5): 669–672. Menasha, October 1948), having been "first collected in a light-trap in the Pearl Harbor area in April, 1946. On July 23, it was found breeding in millions in salt-water ponds near the Moanalua Gardens in a suburban area between Honolulu and Pearl Harbor."

Notiphila erythrocera Loew, originally described from Cuba, was identified by Herr Victor von Roeder from Puerto Rico from material collected by Dr. Gundlach.

Notiphila furcata (Coquillett), originally described as a *Dichaeta* from Biscayne Bay, Florida, was identified by Mr. E. T. Cresson, Jr., (*in* Curran 1928–59) from San Juan, Puerto Rico and from Ensenada.

Notiphila virgata, described by Mr. D. W. Coquillett (1900–259) from Puerto Rico, was identified by Mr. E. T. Cresson, Jr., (*in* Curran 1928–59) from San Juan, Naguabo, Corozal and Adjuntas, and Dr. Curran identified specimens from Tortuguero Lagoon.

Discomyza dubia Williston, originally described from St. Vincent, was identified by Dr. C. H. Curran (1928–62) from the U. S. Virgin Islands of St. Croix and St. Thomas, and from Manatí in Puerto Rico.

Discomyza maculipennis Wiedemann, as identified by Dr. J. M. Aldrich, was intercepted on the hedge of "café de la India" (*Chalcas exotica*) around the Post Office building in San Juan, and on the SS "Catherine" in San Juan harbor.

Paralimna ciliata Cresson was identified by Mr. E. T. Cresson, Jr. (*in* Curran 1928–60) from San Juan, Aibonito and Coamo.

Paralimna decipiens Loew is recorded from Puerto Rico by Mr. D. W. Coquillett (1900–259), and from Georgia and Florida.

Paralimna obscura Williston, originally described from St. Vincent, is listed from Puerto Rico by Mr. Coquillett.

Paralimna plumbiceps Cresson was identified by Mr. E. T. Cresson, Jr. (*in* Curran 1928–60) from Adjuntas and Coamo.

Ptilomyia enigma was described by Mr. D. W. Coquillett (1900–261) from Puerto Rico, the type collected by Mr. Aug. Busck.

Hydrellia calverti Cresson was identified by Mr. E. T. Cresson, Jr. (*in* Curran 1928–60) from Naguabo, Arecibo, Adjuntas and Aibonito.

Hydrellia gilvipes was described by Mr. D. W. Coquillett (1900–261) from Puerto Rico, the type collected by Mr. Aug. Busck.

Pseudohecamede abdominalis (Williston), originally described as a *Hecamede* from St. Vincent and Brasil, was identified by Mr. D. W. Coquillett (1900–260) from Puerto Rico.

Psilopa skinneri Cresson was identified by Mr. E. T. Cresson, Jr. (*in* Curran 1928–60) from Naguabo, San Juan, Cayey, Jayuya and Mayagüez.

Psilopa unica Cresson was identified by its describer (*in* Curran 1928–60) from Adjuntas and Mayagüez, now by Dr. Wirth placed in synonymy with **pulchripes** Loew.

Ilythea fenestralis Cresson was identified by its describer (*in* Curran 1928–60), a single specimen from Aibonito.

Zero flavipes (Williston), originally described from St. Vincent, and also recorded from Brasil, was identified by Mr. D. W. Coquillett from Puerto Rico, and also **Ilythea oscitans** (Walker) as a distinct and valid species.

Athyroglossa nitida Williston, originally described from St. Vincent, is listed by Mr. D. W. Coquillett from Puerto Rico. It has been intercepted at Naguabo.

Hydrochamasa leucoprocta (Loew) was identified by Mr. D. W. Coquillett from Puerto Rico, and he described *Discocerina incisa* (Jour. N. Y. Ent. Soc., **10:** 182. New York, 1902) from type material collected here by Mr. Aug. Busck. Mr. E. T. Cresson, Jr. (Trans. Amer. Ent. Soc., **44:** 58. Philadelphia, 1918) considers the latter a subspecies of the former, and under the name **Discocerina leucoprocta** subspecies **incisa** Coquillett (*in* Curran 1928–62) lists flies collected at San Juan, Manatí, Coamo and Mayagüez.

Discocerina obscura Williston, originally described from St. Vincent, is identified from Puerto Rico by Mr. E. T. Cresson, Jr. (*in* Curran 1928–63): specimens from Naguabo, Cayey and Mayagüez. Dr. Wirth puts it in the subgenus (**Lamproclasiopa**).

Discocerina obscurella (Fallén), first identified from Puerto Rico by Mr.

D. W. Coquillett (1900–261) as *D. parva* Loew, is listed by Mr. E. T. Cresson, Jr. (*in* Curran 1928–63) from Mayagüez and Mona Island. Dr. Wirth considers it the subspecies **nitidiventris** Hendel.

Ceropsilopa adjuncta was described by Mr. E. T. Cresson, Jr. (Entomological News, **36** (6): 165. Philadelphia, 1925), the type from Adjuntas, others from Manatí, Arecibo and Naguabo, as noted in Cresson (1928–61).

Ceropsilopa coquilletti was described by Mr. E. T. Cresson, Jr. (Entomological News, **33:** 136. Philadelphia, 1922) from a single specimen collected on Mona Island by Dr. Frank E. Lutz, as noted in Curran (1928–61).

Ceropsilopa mellipes was described by Mr. D. W. Coquillett (1900–260) as a *Psilopa* from Puerto Rico, the type collected by Mr. Aug. Busck. This fly was later identified by Mr. E. T. Cresson, Jr. (*in* Curran 1928–61) from Naguabo, Adjuntas and Arecibo.

Typopsilopa flavitarsis Cresson, originally described from Bill Williams Fork, Arizona, is recognized by its describer (*in* Curran 1928–61) from Mayagüez and Arecibo.

Leptopsilopa nigrimana (Williston), originally described as *Psilopa nigrimana* Williston from St. Vincent and Brasil, is recognized by Mr. E. T. Cresson, Jr. (*in* Curran 1928–61) from many Puerto Rican localities and from Desecheo Island. It has been intercepted at Bayamón.

Plagiopsis aciculata (Loew), originally described as a *Psilopa* from Cuba, and recorded from St. Vincent and Brasil, was listed by Mr. D. W. Coquillett (1900–260) from Puerto Rico, and was recognized by Mr. E. T. Cresson, Jr. (*in* Curran 1928–62) from many Puerto Rican localities and from Mona Island.

Parathyroglossa centralis (Cresson) is recognized by its describer (*in* Curran 1928-63) from Mayagüez and San Juan.

Anthyroglossa laevis (Cresson) is recognized by its describer (*in* Curran 1928–63) from many Puerto Rican localities.

Chloropidae or Oscinidae: Frit Flies, "Mimis."

The elongate, brownish-green, scale-like larvae of some species of Chloropid fly of which the adult has not been reared, is sometimes to be found on the leaves of young sugar-cane, specimens collected at Guánica having been identified by Mr. C. T. Greene as "near *Meromyza.*" They have been noted in all parts of the Island, but never in abundance.

Chloropisca atra was described by Dr. C. H. Curran (1926–3) from a single female from Arecibo, 2.6 mm. long, with "largely pale colored legs."

Chlorops trivittata Williston, originally described from St. Vincent, was listed by Mr. D. W. Coquillett from Puerto Rico.

Cadrema pallida (Loew), originally described as an *Hippelates* from Cuba, is identified by Dr. C. H. Curran (1928–45) from a single specimen collected by Dr. Frank E. Lutz on Mona Island.

Hippelates apicata, described from Puerto Rico by Mr. J. R. Malloch in "The Genera of Flies of the Subfamily Botanodiinae with hind tibial Spur" (Proc. U. S. National Museum, 46 (2024), pp. 242–55. Washington, D. C., December 6, 1913) on p. 248, is recognized by Dr. C. H. Curran (1928–50) from Mona Island.

Hippelates bicolor Coquillett, originally described from Lake Worth, Florida, is identified by Dr. C. H. Curran (1928–49) from St. Thomas, Manatí in Puerto Rico, and from Mona Island.

Hippelates convexus Loew, originally described from Cuba, is first reported from Puerto Rico by Mr. D. W. Coquillett (1900–265), who (Bulletin No. 10, new series, Division of Entomology, pp. 70–79. Washington, D. C., 1898) notes that the larvae of this little fly occur in burrows in sugar-cane in Florida. Its occurrence in Puerto Rico is recorded by Mr. J. R. Malloch (1913–249), and Dr. C. H. Curran (1928–48) lists it from St. Thomas, from many localities in Puerto Rico, and from Mona Island.

Hippelates collusor was described by Dr. D. H. Curran (1926–4) from a single female from St. Thomas, others from Manatí, Puerto Rico, and from Mona Island. It is 1.5 to 2.0 mm. long, "allied to *bicolor* Coquillett (which) has a much longer vertical triangle."

Hippelates dorsatus Williston, originally described from St. Vincent, is recognized by Dr. C. H. Curran (1928–46) from Mona Island: three specimens collected by Dr. Frank E. Lutz.

Hippelates flavipes Loew, originally described from Cuba, was first identified from Puerto Rico by Mr. D. W. Coquillett (1900–265), and listed by Mr. R. H. Van Zwaluwenburg as number 1712. Dr. C. H. Curran (1928–49) identifies it from the Island of St. Thomas, from San Juan, Arecibo and Orocovis in Puerto Rico, and from Mona Island, and (1931–11) from Vieques Island. He also identified as *H. partitus* Becker, which is the male of *H. flavipes* Loew, a single specimen from Aibonito (1928–48), and subsequently (1931–11) a male from Vieques Island collected by Prof. Wm. T. M. Forbes. It has been intercepted in San Juan, resting on the hedge of "café de la India" (*Chalcas exotica*) around the Post Office building. *Hippelates nudifrons*, described by Mr. J. R. Malloch (1913–242), the type from Puerto Rico and from Vieques Island, is another synonym.

Hippelates ilicis was described by Dr. C. H. Curran (1926–4) from a male from Arecibo, Puerto Rico, others from Manatí, and additional specimens from St. Thomas. It is 1.5 to 2.0 mm. long, "colored as in *apicata* Malloch (of which Mr. Sabrosky considers it a synonym), but the mesonotum is less hairy."

Hippelates incipens was described by Dr. C. H. Curran (1926–5) from a female from Naguabo, another from Coamo Springs, Puerto Rico.

Hippelates impressus Becker was identified by Dr. C. H. Curran (1928–

47) from fourteen specimens collected on the Island of Desecheo, February 18–20, 1914, by Dr. Frank E. Lutz.

Hippelates lutzi was described by Dr. C. H. Curran (1926–5) in honor of its collector, Dr. Frank E. Lutz; the types from Mona Island, February 21–26, 1914. It may be "readily recognized by the entirely pale yellow abdomen and legs, face, cheeks and front reddish-yellow; thorax and scutellum shining black; legs and abdomen wholly pale yellow; wings hyaline, veins yellow."

Hippelates nigricoxa Malloch was identified by Dr. C. H. Curran (1928–48) from St. Thomas, and from many localities in Puerto Rico.

Hippelates nobilis Loew, a continental species, was identified by Dr. C. H. Curran (1928–48) from Arecibo, Aibonito and Adjuntas.

Hippelates pallipes Loew, as determined by Dr. J. M. Aldrich, together with **Hippelates pusio** Lew, also determined by Dr. Aldrich, are reported by Dr. H. L. Van Volkenberg (1939–4) as "common on cattle and other animals. Apparently these two species are the most common of the *Hippelates* attracted to cattle and other livestock," altho only a single collection, recorded as Bishopp No. 18780, was made on which to base this statement. Previous identification by Dr. Aldrich of material collected at Guánica, from dogs, horses and man, was *Hippelates texanus* Malloch, but even this may not include all the species lumped together under the term "mimi" to designate the tiresome and annoying little black flies which tend to swarm at every body opening of the larger mammals, at wounds and sores, and even often coming to rest on any part of the body of a sweaty horse or its rider. Not entirely absent in the more humid parts of the Island or in the mountains, they become very numerous in the more xerophytic areas, and most active during the hottest and brightest part of the day. They even enter houses, and may be excluded only when the shutters are kept closed (incidentally also cutting out the breeze), so that the inhabitants live in semi-darkeness when the sun is shining most brightly outside. At Haina, Santo Domingo, mimis, identified by Dr. J. M. Aldrich as *Hippelates flavipes* Loew, entered the room within a few minutes after the sun rose, and were excluded by closing the shutters and keeping them closed until a few minutes before sunset. Mr. C. W. Sabrasky states that *H. pallipes* does not occur in Puerto Rico and all records under that name are probably **Hippelates flavipes** Loew. *Hippeoates texanus* is a synonym of *H. dissidens* (Tucker), but he doubts the occurrence of this species in Puerto Rico.

Hippelates pusio Loew, originally described from Texas, but noted by Mr. D. W. Coquillett (1900–265) as occurring "as far north as New Bedford, Mass." as well as in Puerto Rico, is listed by Dr. C. H. Curran (1928–49) as having been collected only at Arecibo, Adjuntas, Ensenada and on

Mona Island. This species and *Hippelates flavipes* Loew are cited by Dr. E. A. Schwarz in "The Hippelates Plague in Florida" (Insect Life, VII, p. 374–9, illus. Washington, D. C., July 1895) as most annoying to people and dogs.

Hippelates peruanus Becker is first recorded from Puerto Rico by Mr. J. R. Malloch (1913–244). Dr. C. H. Curran (1928–49) recognizes it from St. Croix, in Puerto Rico from San Juan, Arecibo, Jayuya and Adjuntas, and (1931–11) from Vieques Island.

Hippelates scutellaris Williston, originally described from St. Vincent, is represented in the collections examined by Dr. C. H. Curran (1928–47) by a single specimen from Adjuntas.

Hippelates tener was described from Puerto Rico by Mr. D. W. Coquillett (1900–265), and was noted by Mr. J. R. Malloch (1913–255). Dr. C. H. Curran (1928–47) lists but a single specimen from Arecibo, and one from Mona Island.

Eugaurax insularis was described by Mr. J. R. Malloch (Insecutor Inscitiae Menstruus, **1**: 61. 1913) from specimens from Puerto Rico previously reported by Dr. D. W. Coquillett as *Oscinis qudrilineata* Williston, according to Mr. C. W. Sabrosky (Jour. Washington Academy of Sciences, **40** (6): 188. June 15, 1950).

Pseudogaurax lancifer was described by Mr. D. W. Coquillett (1900–265) as a *Gaurax* from Puerto Rico and the Island of Montserrat, reared from the egg-sacs of spiders. Those of *Gasteracanthia cancriformis* covered with greenish silk served as host at Pt. Cangrejos and Río Piedras, and possibly may have been the species from which the type was reared. These little yellow flies, with enormous scuttelum, have brown eyes and abdomen, and median stripe from base of thorax. One was intercepted resting on a guava leaf at Barceloneta.

Pseudogaurax misceomaculata was described by Mr. David G. Hall as one of "The North and Central American spider parasites of the genus *Pseudogaurax* (Diptera: Chloropidae)" (Jour. Washington Academy Sciences, **27** (6): 255–261, fig. 7. Washington, D. C., June 15, 1937) from a single specimen intercepted at Bayamón by Mr. C. G. Anderson, January 28, 1934, on leaves of flamboyán. It has a broad median band on thorax extending to apex.

Elachiptera flavida Williston, described originally from St. Vincent, was recognized by Dr. C. H. Curran (1928–50) from Puerto Rico: a single female from Cayey.

Madiza mattea was described by Dr. C. H. Curran (1926–5) from a single male from Adjuntas, 1.25 mm. long, of which "the vertical triangle reaches the anterior margin of the front and the tibiae are pale."

Madiza quinquilineata (Adams) is recognized, with some doubt, by Dr.

C. H. Curran (1928–50) from St. Thomas, and Manatí and Coamo in Puerto Rico.

Siphunculina signata (Wollaston) as determined by Dr. J. M. Aldrich, was intercepted in the metropolitan area of San Juan.

Oscinella anonyma (Williston), originally described as an *Oscinis* from St. Vincent, was listed from Puerto Rico by Mr. D. W. Coquillett from various localities, and Dr. C. H. Curran (1928–54) doubtfully identifies it from Naguabo, Cayey, Manatí and Arecibo.

Oscinella anonyma var. **pura** was described by Dr. C. H. Curran (1926–7) as a *Botanobia* from a single male from San Juan, and another from Roseau, Dominica, B. W. I., with (1928–52 and 54) the head and wing illustrated.

Oscinella confusa (Malloch) is recognized and re-described by Dr. C. H. Curran (1928–55) from females from Cayey and Mayaguez, as a *Botanobia*.

Oscinella diversipes is described as a *Botanobia* by Dr. C. H. Curran (1926–7) from a male and others from Arecibo, 1.75 mm. long, with "wholly yellow anterior femora."

Oscinella forbesi was described by Dr. C. H. Curran (1931–12) and named in honor of the collector: Prof. Wm. T. M. Forbes, from a pair and many others from Vieques Island, besides others from the Island of St. Thomas, and many from the humid areas of Puerto Rico. This fly is distinct from *O. coxendix* Fitch, recorded from Puerto Rico by Mr. D. W. Coquillett (1900–266) and "from New Hampshire to Florida and westward to Colorado." According to Dr. Curran it "does not occur on the Islands." *O. forbesi* is 1.1 to 1.5 mm. long, "black, the head and legs largely yellowish; mesonotum wholly pollinose, ocellar triangle pollinose."

Oscinella limitata Becker, originally described from Haiti, is recognized by Dr. C. H. Curran (1928–53) from the Island of St. Thomas, from many localities in the more humid and mountainous parts of Puerto Rico, and from Mona Island.

Oscinella lutzi was described as a *Botanobia* by Dr. C. H. Curran (1926–6) from a single male from Arecibo, and others from there and Adjuntas.

Oscinella mars was described by Dr. C. H. Curran as a *Botanobia* (1926–10) from flies collected at Naguabo, others from Mona Island. The head is illustrated (1928–53) and the wing (1928–57), with no record of additional collections.

Oscinella mona was described as a *Botanobia* by Dr. C. H. Curran (1926–9) from 23 specimens collected by Dr. Frank E. Lutz on Mona Island, and to date found nowhere else, the subsequent notice (1928–56) being accompanied only by figures of the head and wing.

Oscinella magnipalpoides was described as a *Botanobia* by Dr. C. H.

Curran (1926–11) from a pair from Arecibo, others from San Juan, his later notice (1928–57) merely accompanying figures of head and wing.

Oscinella nana (Williston), described as an *Oscinis* from St. Vincent, is identified from Puerto Rico by Mr. D. W. Coquillett (1900–267).

Oscinella obscura (Coquillett), described (1900–266) from Puerto Rico, the type collected by Mr. Aug. Busck, is recognized by Dr. C. H. Curran (1928–56) from Naguabo, San Juan and Manatí, having black palpi, "wholly yellow anterior four tibiae."

Oscinella palliata was described as a *Botanobia* by Dr. C. H. Curran (1926–8) from eight specimens from Adjuntas, 2.5 to 3.0 mm. long, the legs reddish, "wings with a slightly brownish tinge."

Oscinella plesia was described by Dr. C. H. Curran (1926–11) as a *Botanobia* from a single female from Arecibo, 1.6 mm. long.

Oscinella sicatrix was described as a *Botanobia* by Dr. C. H. Curran (1926-8) from seventeen reddish-brown flies from Mona Island collected by Dr. Frank E. Lutz, which, on the posterior tibiae "bear an unusually conspicuous, elongate sensory area." Later mention (1928–56) is accompanied by figures of head and wing.

Oscinella tripunctata was described as a *Botanobia* by Dr. C. H. Curran (1926-10) from three flies collected by Dr. Frank E. Lutz on Mona Island. His later record (1928-56) accompanies figures of head and wing.

Oscinella umbrosa (Loew), a continental species reared from wheat, and reported from Puerto Rico by Mr. D. W. Coquillett (1900–267), and *Oscinella virgata* (Coquillett), originally described as an *Oscinis* from Colorado, also recognized by the describer from Puerto Rico, may presumably be referred to some of the numerous endemic species since described by Dr. Curran.

Oscinella varipalpus was described by Dr. C. H. Curran (1926-12) as a *Botanobia* from three black flies, 1.75 mm. long, from Mona Island, and one from San Juan, Puerto Rico. His later record (1928–28) is accompanied by figures of wing and head.

Asteiidae

Crepidohamma bicolor (Loew), originally described as a *Sigaloëssa* from Cuba and thus listed from Puerto Rico by Mr. D. W. Coquillett (1900–267), has been intercepted resting on banana at Bayamón. Its mesonotum and front are wholly shining black.

Crepidohamma rica (Curran) (= *Sigaloëssa insularis* Curran 1931, not Malloch 1930) was described from a single female collected by Prof. Wm. T. M. Forbes on Vieques Island, 1.5 mm. long, "brownish red or pale ferrugineous and yellow."

Drosophilidae: Pomace Flies

Drosophila ananassas de Meijere was identified by Dr. J. T. Patterson for Dr. G. A. Lebedeff, who collected this material from banana fruit. Dr. Lebedeff, previous to his employment in the Division of Genetics, Agricultural Experiment Station at Río Piedras, had worked extensively in the genetics of Drosophilid flies, and upon arrival in Puerto Rico, collected material for identification. This is the only new record for Puerto Rico of what he submitted for determination.

Drosophila ampelophila Loew, described originally from Cuba, but found in Europe, north Africa and in the United States, where it is called by Prof. John R. Comstock "the vine-loving pommace fly," the larvae developing in apple pommace or decaying applies, has been repeatedly intercepted in Puerto Rico, as identified by Mr. C. T. Green, on banana at Maricao, on guava at Arecibo, and on non-significant hosts in the metropolitan area. It has been reared from ripe fruit of "jobo" or hog-plum (*Spondias mombin*) at Río Piedras. Dr. Wirth places it in synonymy with **melanogaster** Meigen.

Drosophila funebris (Fabricius), originally described as a *Musca* from Europe, was recorded by Mr. D. W. Coquillett (1900-264) from Puerto Rico and "over the greater portion of the United States."

Drosophila fusca was described by Mr. D. W. Coquillett (1900-264) from material collected in Puerto Rico by Mr. Aug. Busck. It is probably **lutzii.**

Drosophila lutzi Sturtevant was identified by Dr. C. H. Curran (1928-64) from Puerto Rico, the material he examined containing more than thirty specimens from the Luquillo National Forest.

Drosophila melanica Sturtevant, as identified with some doubt by Mr. C. T. Greene, was intercepted by Mr. R. G. Oakley at Adjuntas.

Drosophila melanogaster Meigen was first listed from Puerto Rico by Mr. H. H. Van Zwaluwenburg as P. R. 110. Dr. Richard T. Cotton reared these flies from fallen and decaying oranges at Río Piedras, as identified by Dr. J. M. Aldrich, and Dr. J. A. Patterson identified as this species the material submitted by Dr. G. A. Lebedeff, collected on banana fruit.

Drosophila repleta Wollaston, identified by Mr. C. T. Greene, as *D. punctulata* Loew, has been intercepted in the metropolitan area, reared from ripe and rotting fruit of "jobo" or hog-plum (*Spondias mombin*).

Drosophila repleta Wollaston was first identified from Puerto Rico by Dr. C. H. Curran (1928-64): two specimens from Santurce: later, others in the AMC collection from Mayagüez, Coamo and Río Piedras It has

been intercepted in grapefruit groves at Palo Seco and Añasco, and reared from a ripe fruit on the tree in a grove at Barceloneta.

Drosophila similis Williston is one of the many of this genus described from St. Vincent which occurs in Puerto Rico, Dr. C. H. Curran identifying specimens from Mayagüez in the AMC collection.

Dr. J. M. Aldrich identified only to "sp. nov." the *Drosophila* reared from the ovary of the flower of "tibéy" (*Isotoma longiflora*), at Río Piedras and intercepted at Vega Baja.

Scaptomyza vittata (Coquillett), described as a *Drosophila* from Charlotte Harbor, Florida, was recognized by the describer as present in Puerto Rico (1900-264), and has since been intercepted at Vega Baja, resting on squash.

Cladochaeta nebulosa was described from Puerto Rico by Mr. D. W. Coquillett (1900-263), the type collected by Mr. Aug. Busck.

Leucophenga frontalis (Williston), described originally as a *Drosophila* from St. Vincent, was identified by Dr. C. H. Curran from Puerto Rico: specimens in the AMC collection from Coamo Springs, Río Piedras and Mayaguez.

Leucophenga varia (Walker), a continental species originally described as a *Drosophila* from Georgia, was identified from Puerto Rico by Mr. C. T. Greene, resting on a leaf of young sugar-cane at Coloso.

Geomyzidae

Anthomyza nigrimanus was described by Mr. D. W. Coquillett (1900-264) from Puerto Rican material collected by Mr. Aug. Busck. Dr. J. M. Aldrich identified as a new species of *Tethina* a fly intercepted at San Juan.

Stenomicra angustata was described by Mr. D. W. Coquillett (1900-262) from material collected by Mr. Aug. Busck in Puerto Rico, but has not since been noted.

Agromyzidae: Leaf-Mining Flies

Agromyza caerulea Malloch is presumed by Dr. J. M. Aldrich to be the *Agromyza aeneiventris* Fallén reported from Puerto Rico by Mr. D. W. Coquillett (1900-268). *Agromyza aeneiventris* Fallén is the doubtful determination by Mr. C. T. Greene of flies very persistent in resting on the leaves of "cucubano" (*Coccoloba laurifolia*) on Mona Island. It has since been intercepted in the common "margarita" or shepherd's needles (*Bidens pilosa*) from Guayama, and reared from the stem of *Eupatorium odoratum* and from seeds of morning glory by Dr. Richard T. Cotton. Messers. W. K. Bailey and H. K. Plank report it as "An Agromyzid Fly Infesting Sweet Potato Seed in Puerto Rico" (Jour. Ec. Ent., **33** (4): 704–5. Menasha,

August 1940), attacking the true botanical seed; not slips or small tubers, and so rarely (less than 2% infestation) as hardly to be of economic importance even to the plant breeder.

Agromyza ipomaeae was described by Prof. S. W. Frost as one of "New Species of West Indian Agromyzidae (Diptera)" (Entomological News, **43** (3): 72-6. Philadelphia, March 1931), the type from Puerto Rico: the larva a miner in the leaves of sweet potatoes. Dr. M. D. Leonard (1931-119, 1932-137, 1933-123) noted the presence of this leaf-miner in all fields of sweet potatoes examined, but not in sufficient abundance to be of economic importance.

Agromyza inaequalis was described by Mr. J. R. Malloch (Proc. Ent. Soc. Washington, **16** (2): 89–90, fig. 1. Washington, D. C., June 1914) from material reared by Mr. Thos. H. Jones from leaves of beans (*Vigna repens*) at Río Piedras. This leaf-miner also attacks the leaves of lima beans and Dr. M. D. Leonard (1932-124) reports a leaf-miner, probably this species, as fairly common on cabbage plants grown at Río Piedras in April.

Agromyza insularis Malloch, as determined by Dr. J. M. Aldrich, was reared by Dr. Richard T. Cotton from seed pods of Chinese mustard.

Agromyza jucunda Van der Wulp, a common continental leaf-miner, was listed by Mr. D. W. Coquillett from numerous hosts in the United States, and without host record from St. Vincent and Puerto Rico. It was identified by Mr. J. R. Malloch for Mr. Thos. H. Jones from adults reared from mined leaves of *Eupatorium odoratum*, and from leaves of wild morning glory intercepted at Vega Alta. Adults have been found resting on the hedge of "café de la India" (*Chalcas exotica*) around the Post Office in San Juan, and intercepted at Guayama, and at Mayagüez in a grapefruit grove.

Agromyza maculosa Malloch was identified by Dr. C. H. Curran (1928-65) from numerous localities in Puerto Rico from Cayey to Ensenada, and specimens from Mayagüez in the AMC collection. Young aster plants, grown from imported seed by Mr. Francisco Seín, had their small leaves almost entirely destroyed by the mines of this species, as determined by Dr. J. M. Aldrich: a record mentioned by Prof. S. W. Frost (1931-76). More recently the leaves of sunflower, *Helianthus annus*, at La Plata, have been found attacked by it.

Agromyza melampyga Loew, a common continental species, was identified by Dr. C. H. Curran (1928-65) from Naguabo and Arecibo.

Agromyza minima was described by Mr. J. R. Malloch in his "Revision of Species of Agromyza" (Ann. Ent. Soc. America, **6** (3): 329. Columbus, 1913), the type from Puerto Rico.

Agromyza neptis Loew was listed from Puerto Rico by Mr. D. W. Coquillett.

Agromyza parvicornis Loew was determined by Mr. W. R. Walton for Mr. Thos. H. Jones, who had reared the adults from mines in the leaves of corn: a record that is noted by Prof. S. W. Frost (1931-36). Dr. C. H. Curran (1928-66) identified a single adult collected at Adjuntas.

Agromyza platyptera Thomson, described originally from California, was identified by Dr. C. H. Curran (1928-65) from Naguabo and Jayuya.

Agromyza plumiseta was described from Puerto Rico by Mr. J. R. Malloch (1913-324).

Agromyza pusilla Meigen was listed from Puerto Rico by Mr. D. W. Coquillet as *Agromyza diminuta* Walker, and has since been repeatedly intercepted: reared at Cidra from larvae mining in pea leaves; at Humacao from larvae in leaf of "cohitre" (*Commelina longicaulis*); at Guayama from flower heads of "margarita" (*Bidens pilosa*). In the Island of St. Croix and St. Thomas, and in Haiti, this leaf-miner is a common pest of onions, making a tunnel that appears light-colored or yellowish part way around the stalk and then irregularly up or down, but not causing irreparable injury unless several or many maggots are present in the single central stalk. Much more severe injury occurs in Chinese cabbage or Chinese mustard, in some instances the entire under surface of the larger outer leaves being destroyed by mass infestations. Mr. Charles E. Wilson, from his experience with the "Truck-Crop Insect Pests in the Virgin Islands and Methods for Combating Them" (Bulletin No. 4, Virgin Islands Agr. Exp. Station, pp. 35, fig. 23. Washington, D. C., 1923), named this the "Mustard Leaf-Miner," and records that "on January 31, 1921, 2,128 larvae were taken from one leaf of elephant-ear mustard. The full-grown worm is of pale yellow color, very active, and when ready to pupate, drops to the ground from the leaf in which it has been feeding. The pupa is small and of light yellowish-brown color." He found the only method of satisfactory control was to pick and destroy such mass-infested leaves. Surprisingly enough, no injury of any of these economic hosts has been noted by this Agromyzid fly in Puerto Rico.

Agromyza setosa Loew is listed from Puerto Rico by Mr. D. W. Coquillett.

Agromyza virens Loew is identified by Dr. C. H. Curran (1928-65) from many Puerto Rican localities from Naguabo to Mayagüez, and from the Virgin Islands of St. Thomas and St. Croix. It has repeatedly been intercepted at Mayagüez.

Agromyza viridula was described from Puerto Rico by Mr. D. W. Coquillett as one of "New Acalyptrate Diptera from North America" (Jour. N.

Y. Ent. Soc., **10:** 190. New York, December 1902). It was recognized by Dr. C. H. Curran (1928-66) from the U. S. Virgin Islands of St. Croix and St. Thomas, and from numerous localities in Puerto Rico. It has been intercepted at Guayama, and at numerous localities in the mountains and on the north coast of Puerto Rico.

Agromyza xanthophora Schimer, as determined by Dr. J. M. Aldrich, has been intercepted in an orange grove at Mayagüez by Mr. A. G. Harley.

Cerodontha dorsalis (Loew), originally described as an *Odontoera* in the United States, a miner in wheat and timothy, was listed from Puerto Rico as a *Ceratomyza* by Mr. D. W. Coquillett (1900-269), and subsequently identified by Mr. J. R. Malloch for Dr. Richard T. Cotton, who had reared adults from mines in the leaves of corn. Altho quite common it is of negligible importance as an economic pest, presumably being heavily parasitized as are the other Agromyzid flies.

"*Cryptochaetum iceryae* (Williston) was one of the natural enemies of *Icerya purchasi* Maskell introduced by F. S. Crawford and Albert Koeble from Australia into California in 1888–9. The adults are 1.5 mm. long, the head and thorax metallic dark blue, and the abdomen iridescent green. They are rather slow in movement, crawling slowly over the cottony cushion scale, inserting one to several minute, oblong, oval, smooth, pearly white eggs preferably in the half grown hosts," according to Dr. E. O. Essig (1926-615). An unsuccessful attempt at introduction of this parasite of the cottony cushion scale into Puerto Rico was made shortly after the hurricane of San Ciprián, its failure being ascribed to the scarcity of the host at this time. Another sending by airmail from Riverside, California, October 31, 1933, was received in good condition at Río Piedras on November 7th, from which adults were released as they emerged, in the Condado. No recovery was obtained from subsequent weekly collections of the host. From a shipment made March 25, 1940 from Whittier, California, received in Río Piedras on the 28th, and taken to Mona Island on the 29th, releases were made daily until April 5th, and all adults emerging subsequently were released at Río Piedras. From numerous collections of *Icerya purchasi* at Río Piedras and in other parts of Puerto Rico, and from Mona Island, no adult of this introduced parasite has been reared.

Chamaemyiidae (Ochthiphilidae)

Leucopis bella Loew, originally described from Cuba, but with an extensive distribution in the United States and southern Canada, was listed by Mr. D. W. Coquillett (1900-269) from Puerto Rico, reared by Mr. Aug. Busck from larvae feeding on the mealybugs *Dactylopius citri.* Mr. D. L. Van Dine reared several of these small grey flies from *Pulvinaria psidii* Maskell, a mealybug on "jobo" (*Spondias mombin*) at Arroyo, in February

1912. A single fly was collected by Prof. Wm. T. M. Forbes on Vieques Island, as identified by Dr. C. H. Curran (1931-13), who notes that the larvae are predaceous on aphids and mealybugs, and may be recognized by their triangular shape.

Acrometopia maculata Coquillett, originally described from Cuba, was identified by Dr. C. H. Curran (1928-66): seven specimens collected by Dr. Frank E. Lutz on Mona Island.

Milichiidae

Eccoptomma montanum Becker, originally described from Perú, is identified by Dr. C. H. Curran (1928-66) from Puerto Rico: a single male from Mayagüez. It is 2.5 mm. long, "black; abdomen argenteous except the base and apex."

Milichiella arcuata (Loew), originally described as a *Milichia* from Long Island, New York, was identified by Dr. C. H. Curran from a single male, collected by Dr. Frank E. Lutz on Desecheo Island.

Milichiella cinerea was described as an *Ophthalmomyia* from Puerto Rico by Mr. D. W. Coquillett (1900-268), the type material having been collected by Mr. Aug. Busck.

Milichiella lacteipennis (Loew), originally described as a *Lobioptera* from Cuba, and listed as an *Ophthalmomyia* from St. Vincent and by Mr. D. W. Coquillett (1900-267) from Puerto Rico, is considered by Dr. C. H. Curran (1928-67) to "agree perfectly with Coquillett's description of *Desmometopa halteralis* (1900-267)," and of it he recognizes specimens from San Juan, Manatí, Adjuntas and Mayagüez in Puerto Rico, and from Desecheo and Mona Islands collected by Dr. Frank E. Lutz. Prof. Wm. T. M. Forbes collected this fly on Vieques Island, as identified by Dr. Curran (1931-14), and it has been intercepted resting on eggplant at Loíza, and on the hedge of "café de la India" (*Chalcas exotica*) around the Post Office building in San Juan.

Desmometopa M-nigrum (Zetterstedt), originally described as an *Agromyza*, was identified by Dr. C. H. Curran (1928-68): a single specimen from Jayuya. It has been intercepted on leaves or flowers of grapefruit at Mayagüez and Arecibo, and also found resting on the hedge of "café de la India (*Chalcas exotica*) around the Post Office building at San Juan. As identified by Mr. C. T. Greene, it was found dead on the window-sill of the cotton gimmery at Isabela after its interior had been sprayed with DDT.

Desmometopa tarsalis Loew, described originally from Cuba, was recognized by Dr. C. H. Curran (1928-68): a single specimen collected by Dr. Frank E. Lutz on Desecheo Island.

Pholeomyia indecora (Loew), originally described as a *Lobioptera* from

Cuba and listed as a *Milichia* by Mr. D. W. Coquillett (1900-263) from Puerto Rico and the United States "ranging from New Hampshire to Georgia," is recognized by Dr. C. H. Curran (1928-68): a single female from Mayagüez and a single female from Mona Island.

Hippoboscidae: Birdflies or Louseflies

Melophagus ovinus (Linnaeus), originally described as a *Hippobosca* from domestic sheep in Europe, was P. R. 91 in Van Zwaluwenburg's list, presumably having been collected on a recently imported sheep. It has not been noted since, but there can be little doubt as to the authenticity of the original record.

Ornithoctona erythrocephala (Leach), originally described as an *Ornithomyia* from Brasil, without host record, is listed by Dr. Stahl as *Ornithomyia cryptocephala* Leach, and by Dr. Gundlach as *Ornithomyia erthrocephala* Leach, as identified by Herr Victor von Roeder, noting that "se encuentra en aves de diferentes familias". It was collected on sparrow hawk by Mr. Aug. Busck at Adjuntas, and on Culebra Island, as noted by Mr. D. W. Coquillett (1900-269). Dr. C. W. Johnson (Psyche, **29**: 84 Cambridge, 1922) also reports it on this host from Puerto Rico. In the AMC collection, as identified by Dr. C. H. Curran, are specimens from Lajas, and from W. I. red-tailed hawk at Las Marías. Dr. J. E. Bequaert in his "Notes on Hippoboscidae. 17. The Hippoboscidae of the Antilles" (Memorias de la Sociedad Cubana de Historia Natural, **14** (4): 305–327. Habana, December 31, 1940), on page 316 gives additional records: at Adjuntas from *Otus nudipes nudipes* (H. E. Anthony); at Parguera from *Asio flammeus portoricensis* (M. Agrait), and at El Yunque, from *Buteo platypterus cubanensis*.

Olfersia aenescens C. G. Thomson, originally described without host record from the Keeling Island in the Indian Ocean, was first identified from Puerto Rico by Dr. J. M. Aldrich as *Olfersia diomedeae* Coquillett, taken from a booby from Desecheo Island on May 1927, by Dr. Stuart T. Danforth. It was subsequently listed by Dr. J. Bequaert (Psyche, 40: 103. Cambridge, 1933) as *Olfersia erythropsis* Bigot, and correctly (1940-320), with the note that it is "almost cosmopolitan in tropical seas, found on various marine birds, particularly albatross, tropic bird, booby, petrel, noddy and tern."

Olfersia fossulata Macquart, originally described from Brasil without host record, was found by Dr. Stuart T. Danforth on booby (*Sula leucogaster*) on Desecheo Island, as recorded by Dr. J. E. Bequaert (1933-105 and 1940-321).

Olfersia spinifera (Leach), originally described as a *Feronia*, was collected by Prof. J. A. Ramos from man-o'war bird (*Fregata magnificens*

rothschildi) at Mayagüez and on Mona Island, the flies being identified by Dr. Alan Stone. According to Dr. Bequaert (1940-320), "this species is found throughout most tropical seas, the normal host being man-o'war birds, although occasionally it strays onto other marine birds."

Lynchia albipennis (Say), originally described as a *Olfersia*, was collected by Dr. Alex Wetmore at Río Piedras, December 22, 1916, the host not recorded. According to Dr. Bequaert (1940-323), it is "common and widely distributed in the New World, from Massachusetts to Brasil and the Galapagos; the usual parasite of many wading birds, accidentally found also on duck and gulls."

Pseudolynchia canariensis (Macquart) was identified from Puerto Rico by Dr. J. M. Aldrich as *Lynchia maura* Bigot, the flies taken from domestic pigeons in 1921. "Originally an Old World fly," according to Dr. Bequaert (1940-324), it "has been spread by man with domestic pigeons to most tropical and warm temperate regions." In Puerto Rico, it has been found on pigeons at Yabucoa, Río Piedras, Coamo, San Germán and Mayagüez.

Streblidae: Batflies

Trichobius dugesii Townsend, described originally from Mexico, was identified by Herr Victor von Roeder as *Strebla vespertilionis* Fallén for Dr. Gundlach, who noted that it "vive sobre los murciélagos, y se le conoce en Cuba y otras Antillas." Mr. D. W. Coquillett lists it from Puerto Rico, as well as from Jamaica and Arizona, and this specimen, collected by Mr. Aug. Busck at Bayamón has been re-examined by Dr. J. E. Bequaert, who confirms the original determination. Dr. J. W. Jobling (Parasitology **30** (3): 383. Baltimore, 1938) records collection in Puerto Rico from *Artibeus jamaicensis*. Dr. H. L. Van Volkenberg (1939-4) records, as identified by Dr. Alan Stone, the collection of this fly from bat by Dr. H. D. Tate at Boquerón.

Trichobius pseudotruncatus Jobling (= *T. kesselae* Jobling), as identified by the describer, was taken from *Artibeus jamaicensis* in Puerto Rico.

Trichobius truncatus Kessel, as identified by Dr. J. W. Jobling, was taken from *Artibeus jamaicensis* in Puerto Rico.

Aspidoptera busckii was described by Mr. D. W. Coquillett as one of "New Genera and Species of Nycteribidae and Hippoboscidae" (Canadian Entomologist, **31** (11): 333–6. London, November 1899), named in honor of the collector who found it on bats (*Artibeus* sp.) at Bayamón.

Pterellipsis aranea was described by Mr. D. W. Coquillett (1899–334) from material collected on bats at Bayamón by Mr. Aug. Busck, and additional specimens from Jamaica and Montserrat. It has since been collected on bats from a cave near Boquerón by Dr. H. D. Tate, as noted by Dr. H. L. Van Volkenberg (1939-4). From a host, *Brachyphylla cavernarum*,

it has been identified by Dr. J. E. Bequaert, as noted by Dr. H. E. Anthony on page 39 of his "Mammals of Porto Rico, Living and Extinct" (Scientific Survey of Porto Rico and the Virgin Islands, 9 (1): 1–238, pl. 54. New York, 1925).

Paradyschira dubia Rudow was identified from Puerto Rico as *P. fusca* Speiser by Dr. J. C. Bequaert, as noted by Dr. Anthony (1925-18), taken from *Noctilio leporinus mastivus* from a cave (Piedra de la Cueva) at Loíza Aldea.

SIPHONAPTERA

Fleas

Pulicidae: Common Fleas

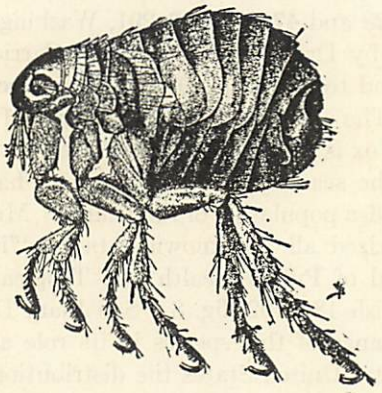
Xenopsylla cheopis (Rothschild), the tropical rat flea, originally described as *Pulex* from Egypt, is by far the most abundant flea in Puerto Rico, not mentioned by Dr. Gundlach, but number 1714 "on rat" in Van Zwaluwenburg's list. In the preliminary, third and final reports on "A Rat-Flea Survey of the City of San Juan, Porto Rico" (P. R. Review (or Journal) of Public Health and Tropical Medicine, **3** (2): 131–145, August 1927; **4** (2): 84–92, San Juan, August 1928; **5** (2): 158–166, San Juan, August 1929, *and* Public Health Reports, **43** (11): 611–616, Washington, D. C., March 16, 1928 and **47** (4): 193–201, Washington, D. C., January 22, 1932) conducted by Drs. O. H. Cox, A. L. Carrion and Carroll Fox, this one flea was found to constitute 99.5 to 98.5 percent of the total flea population of rats. The comparable rat-flea survey of Santurce now being made by Dr. Irving Fox is yielding comparable results as to the abundance of this species and the scarcity of others, to date having added no new records to the known flea population of the Island. Mr. Jenaro Maldonado Capriles has summarized all the known data on "The Fleas of Puerto Rico" (P. R. Journal of Public Health and Tropical Medicine, **21** (2): 173–183 and in Spanish 184–192, fig. 8. San Juan, December 1945), emphasizing the importance of this species in its role as vector of bubonic plague. In continental United States the distribution of this flea is confined to seaport cities and to islands of infestation in the interior, as related by Drs. H. E. Ewing and Irving Fox in discussing "The Fleas of North America" (U. S. D. A. Miscellaneous Publication No. 500, pp. 142, fig. 13, ref. 91. Washington, D. C. February 1943). No information is available as to the rat-flea population of the interior of Puerto Rico, or away from towns in the mountains, as on El Yunque, where rats were extremely abundant when much construction and road building was in progress there.

Ctenocephalides canis (Curtis), given as No. 1708 in Van Zwaluwenburg's list "on dog," was shown in the Cox-Carrion-Fox rat-flea survey to be very scarce on rats. Dr. H. L. Van Volkenberg (1932-26) lists this species as a *Ctenocephalus* as the only one found on mongoose, and (1939-3), without indicating who identified the material, as "very common on dog, also collected from cat and mongoose." "*Ctenocephalides felis* and *C. canis* are almost cosmopolitan," according to Drs. Ewing and Fox (1943-109), "both species having followed man into many parts of the

world. However, in certain regions one species may occur to the exclusion of the other," and Dr. Fox hesitates in asserting that the dog flea is present in Puerto Rico, the typical flea locally present on dogs being *C. felis.*

Ctenocephalides felis (Bouché) is number 1817 in Van Zwaluwenburg's list, "on rat." The Cox-Carrion-Fox rat-flea survey showed it and or the dog flea to be very scarce on rats in Puerto Rico. Dr. M. A. Stewart identified this flea from dog, and from confined calves for Dr. H. L. Von Volkenberg, but he (1939-4) lists it as "common on cat."

Pulex irritans irritans Linnaeus, originally described from material collected on man, in Sweden, is now thought by Drs. Ewing & Fox to have originated in the New World. It was first listed from Puerto Rico by Dr. Stahl, and was identified by Dr. F. C. Bishopp from material collected on



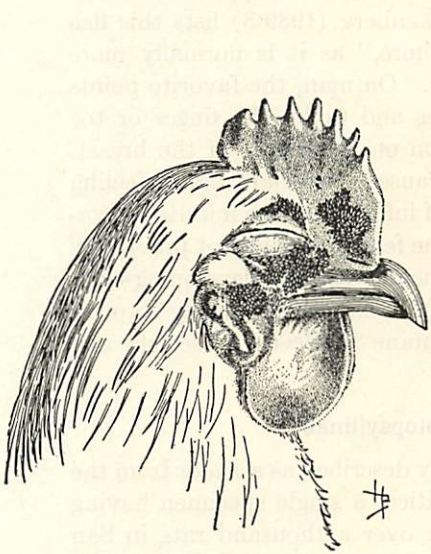
Pulex irritans Linnaeus, greatly enlarged. (After Bishopp, U. S. D. A.)

man at Pt. Cangrejos. Out of over a thousand rats examined in the Cox-Carrion-Fox rat-flea survey, only four fleas of this species were collected. It was not listed from Mayagüez by Mr. R. H. Van Zwaluwenburg, but material from man at Mayagüez was identified by Dr. H. E. Ewing for Dr. H. L. Van Valkenberg, who notes it (1939-3) as "infrequent on dog and rat." The quite general replacement of wooden floors by tile or concrete has greatly reduced the abundance of this flea, for the larvae breeding in the dust-filled cracks of wooden floors, or underneath houses with wooden floors, are now automatically eliminated. Mopping wooden floors with emulsion of kerosene or crude carbolic acid ("creso") was only temporarily effective in rendering them free from fleas, and the early movies, especially the one at Borinquen Park in the Condado and the Tapia Theater in San Juan, were never effectively cleaned of these pests. For persons especially susceptible to infestation by fleas, the performance must be especially

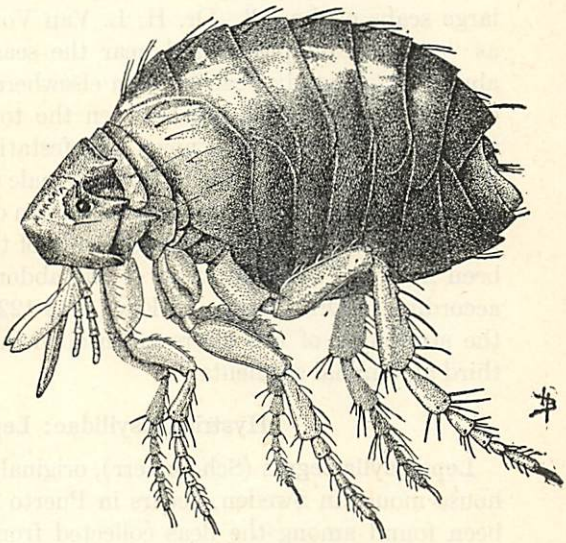
attractive to counterbalance the discomfort to be expected from the fleas that invariably would be picked up. Air-conditioning has also reduced the activities of fleas somewhat, and mechanical cleaners, but the major factor has been the elimination of the dust-filled cracks of wooden floors.

Hectopsyllidae (Echidonophagidae): Burrowing or Sticktight Fleas

Echidnophaga gallinacea (Westwood), originally described as a *Sarcopsyllus* from domestic fowl in Ceylon, has probably been carried with the specific host to most of the tropical and subtropical regions of the world, and presumably has long been present in Puerto Rico, altho not



Head of Rooster infested with Sticktight Fleas. (After Bishopp, U. S. D. A.)



The Sticktight Flea, *Echidnophaga gallinacea* (Westwood), greatly enlarged. (After Bishopp, U. S. D. A.)

listed by either Dr. Stahl or Dr. Gundlach. Indeed, the first record is in Van Zwaluwenburg's list, where it is No. 1719 "on rat and fowls;" an infestation on baby chicks being noted by the parasitologist Dr. G. Dikmans, in the P. R. (Mayagüez) Expt. Station report for 1926 (1927-30) more than a decade later. The Cox-Carrion-Fox rat-flea survey showed that 93 individuals of the sticktight flea had been found on over a thousand rats. Later identifications have been made by Dr. F. C. Bishopp and Mr. H. S. Peters. Dr. H. L. Van Volkenburg (1939-3) lists it as "common on chickens; occasionally serious infestations occur on young birds." The standard remedy for killing the fleas on small chickens is the application of

carbolated vaseline to the infested areas. Its efficiency may be increased by the addition of derris or pyrethrum.

Tunga penetrans (Linnaeus) is listed from Puerto Rico by Herr C. Moritz (1836–377) and Dr. Stahl under its original name, *Pulex penetrans* Linnaeus, the type host being man, from "America." The sand flea or "nigua," common enough in Puerto Rico, is nowhere here sufficiently abundant so that, as in the Dominican Republic, this name is applied to a town. Listed by Mr. R. H. Van Zwaluwenburg as a *Sarcopsyllus*, number 1715 "on man," in "Insectae Portoricensis" (1923–237) it is noted as a *Dermatophilus* "common on man, usually after bathing on sandy beaches (Condado and Pt. Cangrejos), occasionally abundant on clay soil under houses. Supposed to cause large scabs on hogs." Dr. H. L. Van Volkenberg (1939-3) lists this flea as "common on pigs raised near the seashore," as it is normally more abundant on sandy beaches than elsewhere. On man, the favorite points of attack by this flea are between the toes and under the finger or toe nails, but instances are known of infestation on the nipple of the breast. The increase in size of the fertilized female causes a peculiar tingling feeling in the host, and is often the first indication of infestation, the minute brownish spot which is the undistended body of the female having not previously been noted. "The dilatation of the abdomen" with the developing eggs, according to Drs. Ewing and Fox (1943-122), "takes place entirely through the stretching of the intersegmental membrane between the second and third abdominal segments."

Hystrichopsyllidae: Leptopsyllinae

Leptopsylla segnis (Schoonherr), originally described as a *Pulex* from the house mouse in Sweden, occurs in Puerto Rico, a single specimen having been found among the fleas collected from over a thousand rats in San Juan, as reported by Dr. A. L. Carrion (1932-195), the identification having been made by Dr. Carroll Fox.

LEPIDOPTERA

RHOPALOCERA: Butterflies

The types of many of the butterflies of the West Indies are presumed to have been collected in the Danish Island of St. Thomas, which, in the eighteenth century was a busy free port, its harbor filled with the shipping of all nations. The Spanish colony of Puerto Rico had long been closed to the commerce of any other nation than Spain, and often long intervals elapsed between the arrival of ships from the mother country. The first record of the occurrence of well-known West Indian butterflies in Puerto Rico is of collection in 1835 by Herr C. Moritz, whose "Notizen zur Fauna der Insel Puertorico" (Wiegmann's Archiv für Naturgeschichte, **2**: 373–392. Berlin, 1836) lists them largely according to the environment in which they were observed, altho "die blassgelb und schwarz geringelte Raupe" of the Monarch is noted feeding on the leaves of "die feuerroth blühende *Asclepias curassavica*". The names given by Herr Moritz were correct for the day and age in which he lived, and their modern equivalent is given here only for convenience.

Papilio Steneles	*Metamorpha* (or *Victorina*) *stelenes* Linnaeus
Hipp. Jatrophae	*Anartia jatrophae* Johansson
Heli. Charitonia	*Heliconius charithonius* Linnaeus
Vanillae	*Dione vanillae* Linnaeus
Julia	*Dryas* (or *Colaenis*) *iulia* Fabricius
Van. lavinia	*Junonia evarete* Cramer
Hesp. hibisci	?
Eupl. Archippus	*Danaus* (or *Anosia*) *plexippus* Linnaeus
P.Dirce	*Colobura* (or *Gynaecia*) *dirce* Linnaeus
P. Hyperia	*Biblis hyperia* Cramer
"Braune langgeschwänzte Hesperien"	*Urbanus* (or *Eudamus*) *proteus* Linnaeus
"citron-gelbe *Colias*"	*Eurema* spp.
"kleine blassgelb und weissliche *Pontiae*"	*Ascia* (or *Pieris*) *monuste* Linnaeus

The butterflies of Puerto Rico, while not nearly so abundant as in some other tropical regions, are such conspicuous and obvious members of the insular fauna that the inclusiveness of the records by Dr. Agustín Stahl and Dr. Juan Gundlach are naturally to be expected. Dr. Hermann Dewitz identified the butterflies collected by Dr. Gundlach, discovering

among them two new species and two subspecies, described in his paper on the "Tagschmetterlinge von Portorico" (Stettiner Ent. Zeitung, **38**: 233–245, pl. 1. Stettin, 1877). All of these records are included by Herr Heinrich Benno Möschler in "Die Lepidopteren-Fauna von Portorico" (Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, **16**: 69–360, pl. 1, fig. 25. Frankfurt-am-Main, 1890). In more recent years, Dr. Harrison G. Dyar and Dr. Wm. Schaus have identified some additional species, and a few new ones have been described from Puerto Rico. Mr. William Phillips Comstock has prepared such an excellent and wholly satisfactory account of "The Butterflies of Porto Rico" (Scientific Survey of Porto Rico and the Virgin Islands, **12** (4): 421–622, fig. 29, pl. 12, ref. 319. New York, October 12, 1941) that the present account can be considered little more than a summary.

Danaidae

Danaus plexippus (Linnaeus), originally described from "America septentrionali" as a *Papilio*, is the common cosmopolitan milkweed or "Monarch" butterfly, of which three subspecies occur in Puerto Rico. It was listed by Drs. Stahl and Dewitz as *Danais archippus* Fabr., and as *Danaus erippus* Cramer by Herr Möschler and by Dr. Gundlach, the latter noting "la oruga se cría en la *Asclepias curassavica*." As an *Anosia* it is listed by Mr. R. H. Van Zwaluwenburg (2002), and by Dr. Stuart T. Danforth (1926–23) noted as one of the less common species in "the clouds of butterflies which arise as one walks through the fields as one approaches (Cartagena) Lagoon." Ordinarily it is not especially abundant, but Mr. Francisco Seín describes "Una Invasión de Mariposas" (Rev. Agr. P. R., **22** (10): 169–70. San Juan, 1929) in the metropolitan area, flying against the northeast trade winds, about a month after the hurricane of San Felipe (September 13, 1928). Presumably the connection between this migration of butterflies and the hurricane is quite fortuitous, merely serving to date it. The path of migration is at right angles to that of the hurricane, and the area in which the butterflies originated, the southwestern corner of the Island, Mona Island and southeastern Santo Domingo, was practically unaffected by the hurricane.

Danaus plexippus plexippus (Linnaeus) is listed by Prof. J. A. Ramos (1947–52) from Mona Island, and it doubtless finds greater opportunity to develop in large numbers there than in intensively cultivated Puerto Rico. Indeed, Mr. Austin H. Clark in his "Notes on some North and Middle American Danaid Butterflies" (Proc. U. S. National Museum, **90** (3118): 531–542, pl. 4. Washington, D. C., 1941) excludes Puerto Rico from the range of this most widely distributed and cosmopolitan subspecies, but Mr. Wm. P. Comstock (1944–431) states that "it definitely occurs in its typical

form in Puerto Rico." It has "two spots beyond end of cell on forewing and two larger spots between these and apex, light dull orange, contrasting with small white spots on costal border," as shown by a specimen in the Río Piedras collection from Guánica Lagoon. The naked caterpillar, narrowly striped with black, yellow and greenish white, apparently has no muscular control over the paired fleshy black filaments on its prothorax and on the tenth segment, which are neither retractile nor extendible, and exude no odor. The copious exudation of milky juice from the leaves of host, even from the giant milkweed (*Calotropis procera*) of xerophytic regions, seems to bother these caterpillars not at all, altho they often pupate elsewhere than on the host plant. Indeed, it is possible that the larvae of this subspecies develop on the leaves of the giant milkweed, those of the others being restricted to the more slender and less milky *Asclepias curassavica*.

Danaus plexippus megalippe (Hübner), the neotropical subspecies, occurs in Santo Domingo and many of the Lesser Antilles, according to Mr. Austin H. Clark (1941–536), the record for Puerto Rico being a specimen collected by Mr. August Busck at Mayagüez in January 1899, which "lacks the two white spots beyond the end of the cell in the forewing" supposedly typical of this subspecies. In the Río Piedras collection is a specimen reared by Mr. Thos. H. Jones from *Asclepias curassavica* which posesses such white spots.

Danaus plexippus portoricensis was described by Mr. Austin H. Clark (1941–539) as being "smaller; the forewing less than 45 mm. long; pair of white spots just beyond the end of the cell in the forewing absent," known only from Puerto Rico, the type having been intercepted by Messrs. A. S. Mills and C. G. Anderson at Ciales, December 5, 1933. This is Interception Number 4888, which was identified by Dr. Wm. Schaus as a local race of *Danais cleophila* Godart, and was thus recorded in "Insectae Borinquenses" (1936–397). This is the typical monarch butterfly of the mountains and the more humid regions of Puerto Rico, Mr. Wm. P. Comstock (1944–433) listing it from over a dozen such localities. The Río Piedras collection has one specimen from Mona Island, found dead in a spider web.

Danaus gilippus cleothera (Latreille), originally described from Hispaniola, has been collected at Lajas by Prof. J. A. Ramos. "The pattern of the upperside is like that of *plexippus*, but the smaller size of the butterfly immediately distinguishes it," according to Mr. Wm. P. Comstock (1944–435).

Lycorea ceres cleobaea (Latreille), listed from Puerto Rico as *Lycorea cleobaea* Godart by Drs. Dewitz, Stahl and Gundlach, is noted by Herr Möschler (1980–94) as "sehr selten, nur auf einigen Gebirge vorkommen." Mr. Wm. P. Comstock (1944–437) records collections at Adjuntas and

Aibonito; the Río Piedras collection contains one adult from Caguas, taken by Mr. Cesario Pérez in August 1941. This is a fine, large black butterfly, its wings spotted and banded with bright yellow and dull orange, as described in detail by Mr. Comstock, of which the larvae may be expected to be found feeding on the leaves of *Ficus*.

Nymphalidae

Heliconius charithonius charithonius (Linnaeus), originally described as a *Papilio* from America, is one of the most characteristic butterflies of clearings in the woods of the neotropics, the zebra butterfly. Even now, when so much of Puerto Rico is open canefield, one still finds the zebras in the coffee groves and along roads or streams in the virgin forest reserves, as well as at Peñón del Collao between Cayey and Salinas, in Guajataca gorge, and on the Isle of the Caves and the Seboruco woods bordering Laguna San José. Even a minor hurricane like San Ciprián, however, can bring these shy forest denizens to the Plaza of Río Piedras. Dr. Gundlach says of the zebra "es notable por la costumbre que tienen todas las de una localidad de reunirse por la tarde y dormir una al lado de otra. La oruga se cría en especies del género *Passiflora*." Mr. Wm. P. Comstock summarizes the life-history detailed by William Henry Edwards (1884), and the extraordinary appearance of larva and pupa. He has "no doubt that the type specimen of *charithonius* came from one of the Virgin Islands," but we have no record from Culebra and Vieques, altho zebras are common in the shade of the cliffs on Mona Island.

Heliconius charithonius punctatus Hall, a subspecies which is the "constant form in St. Kitts," differs in "having an additional yellow streak in vein Cu_1 of the forewing" and is represented by about a quarter of the specimens from Puerto Rico, according to Mr. Wm. P. Comstock (1944–439).

Eueides cleobaea cleobaea Geyer has not been found in Puerto Rico since listed by Dr. Gundlach as *Eueides cleobaea* Hübner: "La oruga se cría en especies del género *Passiflora*" and by Herr Möschler (1880–95) "selten, Raupe auf Asclepiadisarten."

Dryas iulia juncta was described by Mr. Wm. P. Comstock (1944–441) as a distinct Puerto Rican subspecies of what was first listed from Puerto Rico as *Colaenis delila* Fabricius by Drs. Dewitz, Stahl and Gundlach, the latter noting "la oruga se cría en las *Passifloras*," and called *Colaenis julia* Fabricius in Van Zwaluwenburg's list (P. R. 1419) after specimens collected for the American Museum of Natural History at Aibonito and Mayagüez. Dr. Wm. Schaus identified as *Colaenis cillene* Cramer one of these butterflies intercepted at Cidra but Mr. Comstock refers them all to his local subspecies. Of their "ground color; the upperside is dull fulvous in the males and grayish fulvous in the females": a hardly noticeable dif-

ference unless the two are found together. Altho these large dull-colored butterflies have been found in the metropolitan area they normally frequent more elevated localities, as Indiera and El Yunque, or such comparatively unfrequented regions as Guajataca gorge and the more retired coffee groves.

Dione vanillae insularis (Maynard), originally described as an *Agraulis* from the Bahamas, Cuba and Jamaica, was recorded from Puerto Rico as *Agraulis vanillae* Linnaeus by Drs. Stahl, Dewitz and Gundlach, and by Herr Möschler, both of the latter noting that its larvae feed on *Passiflora*. Considering how comparatively scarce passion vines are anywhere in the tropics it seems most surprising that the caterpilars of so many kinds of tropical butterflies should feed on its leaves. Most of these are comparatively rare, but not *Dione*, which is possibly one of the most abundant butterflies at least in Puerto Rico, and is equally at home in forest reserves and in the metropolitan area; on the beaches, in citrus groves and taking nectar from flowers at the margins of cane fields. It is common on Mona Island, and presumably occurs also on Desecheo, Vieques and Culebra Islands, as in all the Lesser Antilles and westward in the Greater Antilles. One can not fail to recognize it, with bright silvery spots on the underside of both fore and hind wings; the upper surfaces, brownish-orange with black spots, being decidedly less attractive. Prof. J. A. Ramos (1947–52) not only collected adults on Mona, but also larvae on *Corchorus hirsutus*, which were reared to adults. Presumably they had consumed all of the passion vines on which the eggs were laid, and were forced to complete their growth feeding on whatever second choice was available.

Euptoieta hegesia (Cramer), of which Mr. Wm. P. Comstock (1944–444) describes the Puerto Rican subspecies as **watsoni,** was listed by Drs. Dewitz, Stahl and Gundlach, the latter noting "la oruga se cría en la planta *Turnera ulmifolia*." Mr. F. E. Watson, for whom the local subspecies was named, reared larvae from this host near San Juan in the summer of 1914, and collections have been made at Pt. Cangrejos. "The larva is blood-red with short black spines, and forms a pupa about 20 mm. long which has two rows of dorsal tubercles." Mr. E. G. Smyth collected this butterfly at Camuy, Prof. J. A. Ramos at Mayagüez and Lajas, and Dr. Stuart T. Danforth (1926–23) notes it as one of members of the clouds of butterflies in the fields around Cartagena Lagoon.

Phyciodes pelops pelops (Drury), a little brownish butterfly barred with dull orange, was listed from Puerto Rico as a *Melitaea* by Drs. Dewitz, Stahl and Gundlach and by Herr Möschler; Dr. Harrison G. Dyar identified as *Phyciodes anocaona* H. S. the specimen collected by Mr. Thos H. Jones on El Duque, and Dr. Wm. Schaus as *Phyciodes aegon* F. one inter-

cepted in the metropolitan area. It occurs in all parts of Puerto Rico, Mr. F. E. Watson having found it at Manatí, Arecibo, Quebradillas, Mayagüez and Aibonito, and Dr. Luis F. Martorell at Caguas and Cayey.

Phyciodes frisia frisia (Poey) is listed from Puerto Rico by Mr. Arthur Hall in "A Revision of the Genus *Phyciodes* Hubn." (Suppl. Bull. Hill Museum, p. 83, Witley, Surrey, 1929).

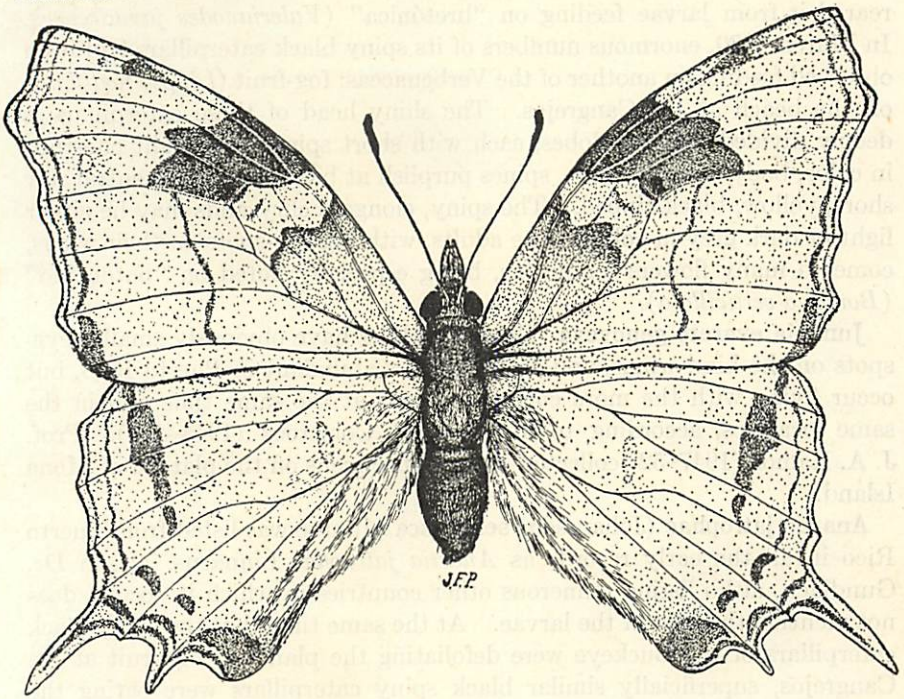
Chlosyne perezi tulita was described by Dr. Herman Dewitz (1877–238) from specimens collected in Puerto Rico by Dr. Gundlach, and using Dr. Gundlach's MS name of *Synchloe tulita*. Dr. Gundlach himself, Dr. Stahl and Herr Möschler all use the generic name of *Coatlantona*, the latter noting (1880–96) "Haufig in dem Gebirgen von Quebredelle von Oktober bis Januar," echoing Dr. Gundlach's observation that it occurs near the coast, possibly because of the host plant of the larva, which Dr. Gundlach did not discover. Mr. F. E. Watson found it at Tallaboa, but Quebradillas is definitely the place where it is most abundant, Dr. Luis F. Martorell having made recent collections in Guajataca gorge. The butterflies are of medium size; "the ground color of the upperside is brownish black with deep orange markings."

Vanessa virginiensis (Drury), the common everlasting butterfly of continental America, is resident in Puerto Rico, one adult having been intercepted at Cayey by Messrs. Richard Faxon, A. S. Mills and C. G. Anderson, as identified by Dr. Wm. Schaus, another at Orocovis collected by Mr. F. E. Watson, and one at Indiera by Prof. J. A. Ramos. Typical nests of the spiny caterpillar on everlasting have been noted in the hills south of Fajardo, but nothing was left to identify the insect but the empty chrysalis skin.

Vanessa cardui (Linnaeus), the common nettle butterfly or "Painted Lady" of continental North America, is a rare visitor to Puerto Rico, listed as a *Pyrameis* by Drs. Dewitz, Stahl and Gundlach, and by Herr Möschler, and since noted but once at Cayey. The anticipated occurrence of the Red Admiral butterfly, *Vanessa atalanta* (Linnaeus), the spiny caterpillars of which also feed on nettle, predicted by Mr. Wm. P. Comstock (1944–451) as "possible" in Puerto Rico because of its presence in Hispaniola, is actually most unlikely, for the mountains of Hispaniola are much higher and have an introduced continental and European flora quite different from the tropical hurricane forests of Puerto Rico.

Hypanartia paullus (Fabricius), originally described as a *Papilio* from Jamaica, was listed from Puerto Rico by Dr. Dewitz as *Euroma tecmesia* Hübner, but Dr. Gundlach and Herr Möschler use the presently accepted name. The adult is a medium-sized yellowish-brown butterfly with darker brown markings, a conspicuous white spot on the forewings, the hindwing tailed at M_3 and Cu_2. The spiny caterpillars hide during the

day in folded-over leaves of "guacimilla" (*Trema micrantha*), as described in detail in "Insectae Portoricensis" (1923–140). The chrysalis is formed in a similar, but uneaten leaf. The caterpillars are really quite common, several often being present on a single small tree, which is typical of cut-over second-growth forest at the higher elevations, or in cuts along new roads in the mountains.



Adult of the Guacimilla Caterpillar, *Hypanartia paullus* (Fabricius), twice natural size. (Drawn by José F. Pietri.)

Junonia evarete (Cramer), the Buckeye butterfly, of which three subspecies occur in Puerto Rico, was first listed as *Junonia lavinia* Cramer by Drs. Dewitz, Stahl and Gundlach, the latter noting "esta especie varía mucho; pero no es igual a la *J. coenia*," and Dr. Stahl also uses the name *Junonia genoveva* Cramer for one of these varieties.

Junonia evarete coenia (Hübner) is presumed to occur in Puerto Rico based on the record of identification of specimens from Mayagüez in the list by Mr. R. H. Van Zwaluwenburg (P. R. 138); material collected by Mr. Thos. H. Jones at Río Piedras in 1912; and an interception in the metropolitan area of San Juan, but the identity of these specimens can not now be determined.

Junonia evarete zonalis (C. and R. Felder) is the common subspecies of the Buckeye in Puerto Rico, to which may be referred the earlier records under the name of *Junonia genoveva* Cramer. It occurs in abundance in all parts of the Island, Dr. Stuart T. Danforth noting it as one of the common butterflies in the fields around Cartagena Lagoon, and Prof. J. A. Ramos lists it from Mona Island. In the summer of 1916, Mr. E. G. Smyth reared it from larvae feeding on "bretónica" (*Valerianodes jamaicense*). In March 1920, enormous numbers of its spiny black caterpillars had been observed feeding on another of the Verbenaceas: fog-fruit (*Lippia nodiflora*) on the beach at Pt. Cangrejos. The shiny head of these caterpillars is deeply divided into two lobes, each with short spine; neck light chestnut in color, body velvety black, spines purplish at base, the more ventral row short, yellow, black-tipped. The spiny, elongate chrysalids may be either light or dark grey in color. The adults, with big eye-spots on their wings, come to many flowers for nectar, being especially noted on "botoncillo" (*Borreria verticillata*).

Junonia evarete genoveva (Cramer) adults have obviously smaller eye-spots on the hind wings, and are much less abundant in Puerto Rico, but occur flying with the more common *zonalis* at the same time and in the same localities, according to Mr. Wm. P. Comstock (1944–456). Prof. J. A. Ramos (1947–52) collected several specimens on the plateau of Mona Island.

Anartia jatrophae (Johansson) **semifusca** Munroe was listed from Puerto Rico in all the early records as *Anartia jatrophae* Linnaeus. Even Dr. Gundlach, altho listing numerous other countries in which it occurs, does not mention the host of the larvae. At the same time that the spiny black caterpillars of the Buckeye were defoliating the plants of fog-fruit at Pt. Cangrejos, superficially similar black spiny caterpillars were eating the leaves of water hysop, *Bacopa monniera*, and mingling with them in seeking a suitable place for pupation. Their shiny black heads had two branched spines; the body with silvery spots more abundant dorsally, warts on first segment, large branching spines on others. The chrysalids were more obviously different; short and plump, light green in color, or opaque purplish-black, with bloom, and from them emerged the characteristic greyish-brown butterflies, barred with dull orange and white, with a conspicuous eye-spot on the forewings and two smaller ones on the hindwings. They occur in all coastal areas of Puerto Rico but were not noted on Mona Island. Dr. Stuart T. Danforth (1926–23) estimated that they constituted nine percent of the clouds of butterflies which arise as one walks thru the fields approaching Cartagena Lagoon. One may doubt, however, if he had not confused their caterpillars with the very similar ones of the Buckeye, feeding on

Lippia reptans, which on September 23, 1924 "were so excessively abundant as to nearly conceal the plants."

Metamorpha stelenes stelenes (Linnaeus), described originally as a *Papilio* from Jamaica, is one of the largest of Puerto Rican butterflies, dark brown with numerous and extensive greenish white spots above, mostly silvery white and light orange beneath, often to be seen along the margins of coffee groves in the mountains, but also present in citrus and coconut groves along the coast. As a *Victorina* it was listed by the earlier workers, Herr Möschler (1880–98) noting "raupe auf *Blechnum* (Gdl.) und *Plantago* (Poey)" and Dr. Wm. Schaus identifying one intercepted at Adjuntas as *V. lavinia* F. *Blechum brownei* is an inconspicuous, low-growing plant of forest margins, locally called "yerba de papagayo," while *Ruellia coccinea*, on which Mr. F. E. Watson found the caterpillars feeding, is "yerba maravilla," both Acantaceas. The fully-grown caterpillar is about 40 mm. long, 7 mm. wide; head glistening black, roughened with long black hairs, and two long black, knobbed and spined horns, 6 mm. long: body velvety black, purplish or dark red at sutures, with four blackened spiny warts on first segment; four branched spines, orange-red or pink, on second and third segments; seven spines on each of the next seven segments, the more ventral ones shorter and all black, the next sometimes pink at base, the three dorsal rows always pink at base and arising from round orange spots, which are coalescent on the first three abdominal segments, but black-tipped, sometimes one-half or two-thirds black; eight spines on the eleventh segment and four arranged in a square on the final segment; true legs black and shiny, prolegs pinkish. The chrysalis is 28 mm. x 10 mm., light green in color, covered with whitish bloom, head and wings transparent; suspended from a pinkish cushion of silk by black cremaster 3.5 mm. long, black, divided at base. Two cephalic horns and one dorsal green horn, with slenderer black interior horns. Five pairs of pink spines on abdomen opposite the end of the wing-pads, besides twelve brighter pink spots anteriorly, and numerous smaller pink and black spots posteriorly. The pupal stage last nine or ten days; the larval stage about twenty days.

Biblis hyperia hyperia (Cramer), originally described by Fabricius as *Papilio biblis* from "America," and in 1779 by Cramer from St. Thomas as a *hypera*, is listed by Dr. Stahl as *Didonis hyperia* and *Biblis thadana*, and by Herr Möschler and Dr. Gundlach as *Didonis biblis* Fabricius: the name on the label of specimens collected by Mr. F. E. Watson at Tallaboa, and generally used since. This is a medium-sized dark brown butterfly, the forewings with a diffused and faded-out marginal band, the hindwings with a comparable band of bright red. Dr. Stuart T. Danforth (1926–23) lists it as one of the more common butterflies around the margin of the Carta-

gena Lagoon, and indeed, it may at times occur in swarms towards Faro de Cabo Rojo, but less abundantly to the east along the south coast, or to the north, individuals having been collected at Arecibo, Manatí and Mameyes. Its presence presumably depends on the readiness with which the nettling "pringamoza" (*Tragia volubilis*) grows, this vine having been discovered by Mr. Cesario Pérez when he was at Quebradillas to be the specific host plant.

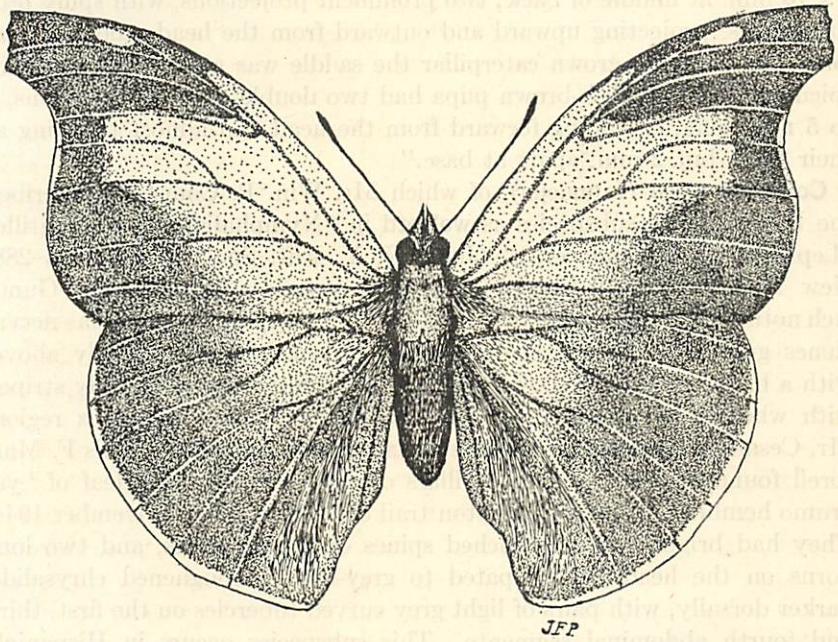
Marpesia petreus thetys (Fabricius) is the name adopted by Mr. Wm. P. Comstock (1944–461) for this rare Puerto Rican butterfly, for which he thinks "it seems proper to resurrect the name *thetys* (Fabricius) for that phase of *petreus* (Cramer of Surinam) which appears north of Panama and extends into Mexico." The latter is the name used by Dr. Stahl and Dr. Dewitz, but Dr. Gundlach adopts the Möschler name of *Megalura peleus* Sulzer. Mr. E. G. Smyth caught a pair of these butterflies at Guánica in July 1915, one dull and pale yellowish brown, the other larger and orange-brown, with three diagonal darker bands extending across both wings, and long, conspicuous tails on the hindwings. The caterpillar feeds on the leaves of fig.

Marpesia chiron (Fabricius) has not been found in Puerto Rico since the records by Drs. Dewitz and Stahl as a *Timetes*, and by Herr Möschler and Dr. Gundlach as a *Megalura*. Dr. Gundlach states that "la oruga se cría en la *Maclura tinctoria* y acaso en el *Xanthoxylon*. El insecto suele posarse encima del fango para chupar." The dyewood "mora" (*Maclura tinctoria*) has been completely eliminated from Puerto Rico for many years, and the caterpillars which preferred its leaves on which to feed presumably perished with it, rather than accept those of "aceitillo" (*Zanthoxylum flavum*), which also is none too abundant despite extensive planting by the Forest Service in recent years.

Hypolimnas misippus (Linnaeus) is one of the most interesting butterflies of Puerto Rico. The female is dark blackish-brown, with a smaller and a larger oval white spot on the forewing and a large white spot on the hindwing. The male is of approximately the same size but mostly brownish-orange, the distal part of the forewing dark with white spots; its general appearance being quite different from that of the female. Dr. Stahl listed it under its presently accepted name, but Dr. Dewitz called it *Diadema bolina* Linnaeus, and Herr Möschler and Dr. Gundlach used this generic name. It has been seen on Mona Island, and presumably occurs in all parts of Puerto Rico, the record being: males at Cayey and along the coast from Palo Seco to Dorado, females at Boquerón, and both sexes in abundance noted by Dr. Luis F. Martorell at Colonia Jauca, Salinas in October 1939. The immature stages have not been noted in Puerto Rico. Mr. Wm. P. Comstock (1944–464) states that "the food plants are said to

be species of Malvaceae, *Ipomoea* and *Portulaca*. The larvae are gregarious. The body of the larva is black with grey bands and rows of whitish, branched spines. The head is reddish with two branched spines. The pupa is light brown with dorsal and lateral tubercles." Dr. Gundlach notes it as "una especie rarísima."

Historis acheronta cadmus (Cramer) has not recently been collected in Puerto Rico, Dr. Gundlach noting that "en el tiempo que hay mangos maduros, acude a ellos para chupar," giving a complicated synonymy under the



Adult of *Historis odius odius* (Fabricius), natural size. (Drawn by José F. Pietri.)

generic name of *Aganisthos*. Ripe mangoes are as popular in Puerto Rico now as in the time of Dr. Gundlach, but they signally fail to attract this butterfly when any entomologist is watching.

Historis odius odius (Fabricius), listed from Puerto Rico as a *Aganisthos* by Drs. Stahl and Gundlach, and as *Aganisthos orion* Fabricius by Dr. Dewitz, is a magnificent big butterfly of the hills and lower mountains, the undersurface of whose wings more or less resembles a brownish leaf. Above, the basal and median portion of the forewing is yellowish-brown, the broad margins velvety black, with a white spot near the apex; the hindwing and body dark brown. Mr. Cesario Pérez collected this butterfly at San Sebastián in December 1942, apparently by chasing after it, but it is

so fond of the juice exuding from coffee shade trees (*Inga vera*) dying of "mal de goma" that it can be captured without a net, as at Ciales in November 1936. Indeed, coffee groves with such dying shade trees seem alive with these powerful big butterflies, but one rarely sees them where such an attractant is absent. Dr. Gundlach was apparently the first to note that the caterpillar feeds on the leaves of the trumpet tree or "yagrumo hembra" (*Cecropia peltata*), and Mr. E. G. Smyth thus describes those he found at Río Piedras towards La Muda: "flattish, medium gray, with white saddle 5 x 10 mm. at middle of back; two prominent projections, with spiny protuberances, projecting upward and outward from the head, about 3 mm. long. In the fully-grown caterpillar the saddle was grayer and less conspicuous. The reddish-brown pupa had two double-curved projections, 4 to 5 mm. long, extending forward from the head and almost touching at their apex, but 2 mm. apart at base."

Colobura dirce (Linnaeus), of which Mr. Wm. P. Comstock described the Puerto Rican subspecies as **wolcotti** in "Nymphalidae of the Antilles (Lepidoptera; Rhopalocera)" (Jour. N. Y. Ent. Soc., **50** (3): 283–288. New York, 1942), was listed by earlier workers as a *Gynaecia*, Dr. Gundlach noting "la oruga vive debajo de la hoja de *Cecropia*, comiendo las nervaciones gruesas." It is a medium-sized, brownish-black butterfly above, with a broad diagonal yellow band across the forewing, intricately striped with white below, apparently most abundant in the Mayagüez region. Mr. Cesario Pérez captured adults at San Sebastián, and Dr. Luis F. Martorell found sixteen black caterpillars on the underside of a leaf of "yagrumo hembra" on the Mt. Britton trail of El Yunque in November 1944. They had bright yellow branched spines on all segments, and two long horns on the head, and pupated to grey-brown, roughened chrysalids, darker dorsally, with pairs of light grey curved tubercles on the first, third and fourth abdominal segments. This subspecies occurs in Hispaniola (and others in Jamaica and Cuba) and possibly on Mona Island, altho not collected there.

Eunica monima (Cramer), originally described as a *Papilio* from "Côte de Guinée," is a small brownish butterfly with five white spots on the forewing, listed from Puerto Rico by all the earlier writers. Swarms of these butterflies, mingled with the following species, were noted by Mr. E. G. Smyth in mid-July, 1915, along the irrigation ditch and sunken road to Tablon No. 13, Hda. Santa Rita, Guánica, but none has been seen there since. Despite their intentness on freshly-crushed stalks of sugar-cane they proved too wary to be caught in his hands on the 13th, but when he returned with a net (and accompanied by the writer) on the 17th they were much less abundant. In March 1940, Dr. Luis F. Martorell collected one specimen on Mona Island.

Eunica tatila Herrich-Schäffer, of which Mr. William James Kaye (1926–473) described the insular subspecies **tatilista** from Jamaica, present also in Cuba, Florida, Hispaniola and Puerto Rico, was listed by all the earlier writers, Dr. Gundlach noting the extent of its variations, "por encima varía por el mayor o menor lustre azul." In all Puerto Rican specimens seen this sheen of the forewings (and to a lesser extent, that of the hindwings) is lavender or purple, definitely not blue, and otherwise they show comparatively little variation, all having six white spots arranged in a pentagon (with one in the middle) on the forewing. In addition to the five adults collected by Mr. E. G. Smyth at the edge of Tablón No. 13 Hda. Santa Rita, the Río Piedras collection contains one other, taken by Don Julio García-Díaz in March 1940 at Río Chavón.

Hamadryas ferox diasia (Fruhstorfer) was not collected in Puerto Rico by Dr. Gundlach, but as *Ageronia ferentina* Godart, he and Herr Möschler relate collection by Dr. Stahl (presumably in the Bayamón region), who sent his specimen to Herr Krug, and "también fué cogido por un colector botánico, el Sr. Sentenis, en el interior de la parte oriental." The AMC collection has one unlabeled specimen, and the Río Piedras collection two, in addition to two specimens collected by Mr. Francisco Seín on trunks of *Inga vera* in coffee grove at Aibonito, January 29, 1924. This is a medium-sized grey butterfly, intricately marked above with darker wavy lines and white spots; beneath for the most part white where it is grey above. It is very common in Hispaniola, where one often finds dozens resting with outspread wings on the trunk of a preferred mango tree, not taking flight until the last minute after discovery. Their wings, tightly appressed to the bark of the tree, often match it so closely in color and mottling as to be almost indistinguishable. Mr. Wm. P. Comstock (1944–472) records collections of adults from Juana Díaz, Guánica, Cartagena Lagoon and Desengaño, and of Fruhstorfer's types from Puerto Rico as well as from Hispaniola. Prof. J. A. Ramos (1947–53) reports collection of these butterflies on Sardinera Beach, Mona Island.

Adelpha gelania arecosa (Hewitson), originally described as a *Heterochroa* from Mexico and the West Indies, and thus listed from Puerto Rico by the earlier writers, was a New Year's capture (1944) by Prof. J. A. Ramos at Indiera. It is not exclusively of the high mountains, however, for Mr. Wm. P. Comstock (1944–473) lists collection at San Juan and Ensenada, as well as at Maricao. It is a small, almost black butterfly, with an oblique chalky white band crossing both wings.

Asterocampa argus idyja (Geyer), listed from Puerto Rico by Drs. Stahl and Gundlach as *Doxocopa* or *Apatura*, is noted by the latter as occurring in Cuba and widely in the United States, the larva feeding on *Ardisia cubana*. It is a yellowish-brown butterfly, even fresh specimens having a

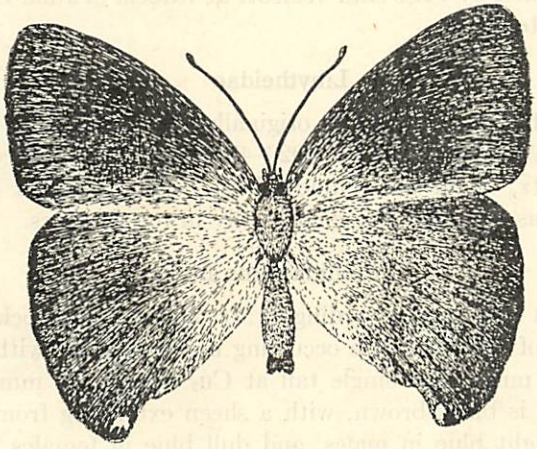
faded-out appearance, of which Mr. Wm. P. Comstock (1944–474) lists collection only at Coamo Springs in Puerto Rico. Dr. Luis F. Martorell collected one of these butterflies at Guajataca gorge, and the Río Piedras collection has another unlabeled specimen.

Prepona antimache insulicola Fruhstorfer is a magnificent big black butterfly with short, iridescent metallic blue-green fascia on both wings; beneath marked with lighter and darker grey. It is found only in the higher hills and mountains. Mr. F. E. Watson collected a female at Ciales, Prof. J. A. Ramos a male at Indiera, but the butterfly is not rare; merely difficult to catch. After heavy rains, one may expect to see one or more of these powerful butterflies at the waterfall of the Río Collazo on the road between Lares and San Sebastián, and Mr. Cesario Pérez captured three of them there. All the earlier writers list this butterfly, and possibly it may have been more abundant when Puerto Rico had more of virgin forest.

Siderone nemesis (Illiger), originally described as *Papilio nobilis nemesis* from "Insel St. Domingo" (Hispaniola), and found also in Cuba, and from Mexico to Brasil, was listed by the earlier workers as *Siderone ide* Hübner from Puerto Rico, altho Dr. Gundlach states that he prefers the older name of *nemesis*. Such a specific name seems hardly significant for such a fine butterfly, with pointed forewings and tailed hindwings that when folded more or less resemble a purplish-brown leaf beneath. Above it has a bloody red triangle at base of forewing and distally an almost equally broad diagonal fascia on a black-brown background that, in certain angles of bright sunlight, shows a purplish sheen. Mr. Wm. P. Comstock (1944–476) reports the food plant of the larva in Mexico as *Casearia abovata*, describes caterpillar and chrysalis, and notes collection in Puerto Rico by Mr. F. E. Watson at Manatí of the adult, and by Prof. J. A. Ramos at Indiera, where it was quite abundant, and by Miss Ann Wolcott at Isabela. Mr. Cesario Pérez collected an adult which shows no sheen at Río Cañas, near Caguas.

Anaea troglodyta (Fabricius) was listed as a *Paphia* from Puerto Rico by the earlier writers, the local subspecies, **borinquenalis,** having been described by Messrs. Frank Johnson and Wm. P. Comstock in their paper on "*Anaea* of the Antilles and their continental Relationships, with descriptions of new Species, Subspecies and Forms" (Jour. N. Y. Ent. Soc., **49** (4); 301–343, pl. 5. New York, 1941). In Van Zwaluwenburg's list two names are given: *Anaea* (*Pyrrhanaea*) *morrisoni* Edwards (P. R. 1413) and *Anaea portia* Fabricius (P. R. 1413), both referring to the same species and subspecies, which varies considerably in the extent of the brownish markings on the orange-red background on the upper side of the wings, the depth of the rose-red sheen, and beneath, the dead-leaf resemblance of the grey or brownish mottling. The caterpillar of the Goatweed butterfly

feeds on *Croton humilis*, and adults are most often noted in xerophytic areas of limestone hills where "yerba bellaca" is the most common vegetation: from Quebradillas, Isabela and Coloso around the west coast of the Island to Guánica, Guayanilla and Ponce. The butterflies themselves may not remain in such barren hills but will be found at irrigation ditches, mud-puddles in country roads, or feeding on the juice of ripe and rotting mangoes or papayas on the ground, almost invisible as long as they keep their wings folded together, but very conspicuous if their upper surfaces are displayed in bright sunlight.



Adult of the Hispaniolan Cane Butterfly, *Calisto pulchella* Lathy, twice natural size. (Drawn by Fritz Maximilien.)

Satyridae: the Satyrs

Calisto nubila was described from Puerto Rico by Mr. Percy I. Lathy in "A Monograph of the Genus *Calisto* Hübner," (Trans. Ent. Soc. London, pt. 2, pp. 221–228, pl. 1, fig. 1–13. London, 1899), the earlier records under the name *Calisto zangis* F., even as late as in Van Zwaluwenburg's list (P. R. 1419), all referring to this one little inconspicuous mountain Satyr, almost wholly black-brown above, lighter beneath with a dark eye-spot in the forewing. It occurs in the hills back from the coast, but most abundantly in the high mountains; at Indiera and on El Yunque, the caterpillar presumably feeding on coarse grasses. Its habitat is quite different from the Hispaniolan cane butterfly, *Calisto pulchella* Lathy, which may swarm at times in the callejones of cane fields close to sea-level, the caterpillars often during the winter becoming injuriously abundant feeding on the older leaves of sugar-cane, as well as on the tender young leaves of the central whorl. In all the years during which enormous quantities of cane

were annually imported into the port of Guánica from La Romana, R. D., no stage of these butterflies arrived in Puerto Rico alive, due to the unceasing vigilance of the local Plant Quarantine Service, which supervised and inspected the fumigation of the cane boats and their cargoes. Other insects, both harmful, neutral and beneficial, are known to have become established in Puerto Rico due to importations from Hispaniola, but not the Hispaniolan cane butterfly against which the quarantine restrictions were formulated.

Megisto cymela (Cramer), as identified by Mr. Wm. P. Comstock (1944–480), was collected by Miss Ann Wolcott at Isabela in June 1938: the only record for Puerto Rico.

Libytheidae

Libytheana terena (Latreille) originally described from the Antilles (according to Mr. Wm. J. Kaye (1926–476) from Puerto Rico), was listed by Drs. Dewitz, Stahl and Gundlach as *Libythea motya* Boisduval & Leconte, but has not been collected locally in recent years.

Lycaenidae: the Blues

Thecla fidena Hewitson, according to Mr. Wm. P. Comstock (1944–485), "is the largest of the Theclinae occurring in Porto Rico, with a length of forewing of 16 mm. The single tail at Cu_2 is about 4 mm. long. The upperside color is black-brown, with a sheen extending from the base of both wings, bright blue in males, and dull blue in females." Listed by Drs. Dewitz and Gundlach, Herr Möschler (1880–101) notes "raupe auf *Tetrapteris*." It was most recently collected by Mr. F. E. Watson at Isabela in 1915.

Thecla acis mars (Fabricius) is characterized by the diagonal white bars, margined with black, on the underside of the wings. It was listed as *Thecla acis* Drury by Drs. Dewitz and Gundlach, and by Herr Möschler, without comment. All recent specimens are from the south coast: Ensenada, Ponce and Coamo, and if this restriction to a xerophytic habitat holds, one can understand why Dr. Stahl made no collection in the Bayamón region.

Thecla angelia Hewitson, of which Messrs. Wm. P. Comstock and E. Irving Huntington in their "Lycaenidae of the Antilles" (Annals N. Y. Academy of Siences, **45** (2): 49-130, pl. 1, ref. 90. New York, December 29, 1943) described the local subspecies as **boyeri,** was listed by all the earlier workers, and has been intercepted in the metropolitan area and on mango blossoms at Mayagüez. Mr. Wm. P. Comstock (1944–487) lists it from Arecibo, Aibonito, Maricao and Coamo, it being a common species in all parts of Puerto Rico as it is in Hispaniola.

Thecla bubastus Cramer, of which Messrs. Comstock and Huntington (1943–79) describe the local subspecies under the name of **ponce,** had not previously been reported from Puerto Rico, but Mr. Wm. P. Comstock lists collections from many coastal localities in Puerto Rico, as well as from the Virgin Islands and many of the Lesser Antilles.

Thecla cardus Hewitson listed by all the early workers from Puerto Rico, is considered by Mr. Wm. P. Comstock (1944-492) to be a possible misidentification for *Thecla christophei* Comstock and Huntington (1943-85) from Hispaniola.

Thecla celida Lucas, of Cuba, was listed by Drs. Dewitz and Gundlach and Herr Möschler from Puerto Rico, of which Messrs. Comstock and Huntington (1943–76) describe the local subspecies under the name **aibonito,** the type from Aibonito.

Thecla columella arecibo Comstock and Huntington (1943–81) was listed, according to the opinion of Mr. Wm. P. Comstock (1944-490), under the name of *Thecla cybira* Hewiston by Drs. Dewitz and Gundlach and Herr Möschler from Puerto Rico, and the identifications by Dr. Wm. Schaus of interceptions at Arecibo and Vega Baja as *Callicista columella* F. and *Thecla eurytulus* Hübner also refer to this subspecies. The type is from Guayanilla, others from Arecibo and Coamo.

Thecla limenia Hewitson, originally described from Jamaica, Cuba and Santo Domingo, was listed by all the early workers from Puerto Rico, and Mr. Wm. P. Comstock (1944-491) lists specimens from many coastal points.

Thecla maesites maesites Herrich-Schäffer was listed by all the earlier workers, and also, not in synonymy *Thecla telea* Hewitson: the continental subspecies, according to Mr. Wm. P. Comstock (1944-488). The latter was identified from Puerto Rico by Dr. Harrison G. Dyar as a *Eupsyche.*

Thecla simaethis simaethis (Drury), listed by all the earlier workers from Puerto Rico, was described from the Island of St. Kitts or "St. Christopher," and has recently been intercepted at Arecibo.

Leptotes cassius theonus (Lucas), was by the earlier workers listed as *Lycaena cassius* Cramer, and by Dr. Wm. Schaus identified from material reared from lima beans at Isabela as *Lycaena theonus* Lucas. "The Larvae of *Lycaena theonus* Lucas feed on the Buds and Flowers of Lima Bean and *Crotalaria incana* in Puerto Rico" (Jour. Agr. Univ. P. R., **18** (3): 435, ref. 1. Río Piedras, (October 1934) is the first local record for the greenish, slug-like caterpillars of this little grey-blue and whitish butterfly, altho Mr. S. C. Bruner had previously noted its attack on the pods of lima beans in Cuba. The wild host plant occurs widely in coastal Puerto Rico, and the butterflies are to be expected in exceptional abundance in commercial plantings of lima beans. Mr. Wm. P. Comstock noted collections on El

Yunque as well as at Ponce, Tallaboa, Guayanilla and Ensenada. He presumes that it was "a very dark phase" of this species (1944-495) which Mr. E. G. Smyth captured at Camuy which Dr. Wm. Schaus identified as *Lycaena marina* Reakirt: a continental species not known to occur in the West Indies. All of these specimens show "the greater prominence and larger size of the marginal eye-spots on the underside of the hindwings."

Hemiargus ammon noëli Comstock and Huntington (1943-99), the subspecies originally described from Hispaniola and named in honor of the Haitian entomological illustrator: Mr. V. Pierre-Noël, was collected by Dr. F. E. Lutz on Mona Island. Altho Dr. Lutz found but a single male, it is really quite common on Mona, Prof. J. A. Ramos (1947–53) listing the collection of numerous specimens from Uvero and Sardinera Beaches. It was this species which Mr. Carl Heinrich identified as "near *zachaeina* B. & D.," collected by Dr. Luis F. Martorell there in April 1940.

Hemiargus ammon (Lucas) **woodruffi,** the subspecies described by Messrs. Comstock and Huntington (1943-100) from the Island of Anegada, British Virgin Islands, is represented in the AMNH collection by four males from San Juan, Puerto Rico.

Hemiargus hanno (Stoll), the local subspecies which Messrs. Comstock and Huntington (1943-106) described under the name of **watsoni,** was listed by all the earlier workers and is P. R. 132 in Van Zwaluwenburg's list. It was collected by Mr. Thos. H. Jones in 1914 near Tortuguero Lagoon as identified by Dr. Harrison G. Dyar, and has been repeatedly intercepted since in all parts of the Island. As *Lycaena filenus* (Poey), Prof. Wm. T. M. Forbes identified for Mr. Cesario Pérez the adults which he had reared from larvae feeding on the buds, flowers and seeds of "habichuela parada" (*Macroptilium lathyroides*). The upperside of the wings of the male are bright violet-blue, their outer margins black-brown with white fringes; those of the female are dark brown, suffused with blue at the bases.

Hemiargus isola isola (Reakirt) is known from Puerto Rico, according to Mr. Wm. P. Comstock (1944-498), from a single male captured by Mr. F. E. Watson at Tallaboa, July 23, 1914.

Hemiargus bornoi Comstock and Huntington, originally described from Haiti, is known from Puerto Rico, according to Mr. Wm. P. Comstock (1944-498) a single specimen captured by Dr. Frank E. Lutz at Ensenada, June 1915.

Pieridae: the Sulfurs and the Whites

Dismorphia spio (Latreille), listed from Puerto Rico by all the earlier writers as a *Leptalis*, is a narrow-winged butterfly of the higher mountains, its brownish-black wings banded with bright orange or bright yellow, or both yellow and orange. Mr. E. G. Smyth found it common near Ma-

meyes on the lower slopes of El Yunque during August, but altho listed from Manatí, Añasco and Mayagüez, most collections have been made high in the mountains at Indiera, or towards the top of El Yunque or El Duque. Nothing is known of the immature stages, but the caterpillar presumably feeds on some endemic plant common to the mountains of all the Antilles.

Anteos maerula maerula (Fabricius), listed as a *Gonepteryx* by the earlier writers, was reared by Dr. Gundlach from larvae feeding on species of *Cassia*. Dr. Luis F. Martorell found numerous larvae feeding on the foliage of "flor de San José" (*Isandrina emarginata*) on the lower slopes of the mountains north of Salinas, which transformed to plump pupae showing on the wingpads greatly enlarged spots of the distinctive black spot characteristic of the wings of the adults. The wings of the male are sulfur-yellow, those of female may be yellow or greyish-white; the spot in the center of the forewing is black; of the hindwing, orange half-circled with black. The determination of the reared adults was by Mr. W. D. Field. The only other recent record from Puerto Rico is of a specimen from Mayagüez, cited by Mr. Wm. P. Comstock (1944-503). Concerning the record of *Anteos* (*Gonepteryx*) *clorinde* Godart ascribed to Dr. Dewitz in "Insectae Portoricensis" (1923-146), Mr. Comstock states that it does not occur in the original paper.

Phoebis (Phoebis) sennae sennae (Linnaeus) is listed from Puerto Rico by Drs. Stahl, Dewitz and Gundlach under the older name of *Callidryas eubule* L., the latter noting "la oruga se cría principalmente en la *Cassia occidentalis*." Mr. Thos. H. Jones reared caterpillars from this host at Río Piedras, and this record was on Van Zwaluwenburg's list as P. R. 1423. Dr. Stuart T. Danforth (1926–23) notes it as one of the common butterflies around Cartagena Lagoon, and Prof. J. A. Ramos found adults on Mona Island. At Hda. Santa Rita, Guánica, the caterpillars were reared eating the flowers of "talantala" (*Herpetica alata*), and distinctly avoiding the tough leaves. The adults come to these flowers apparently in search for nectar, and retaliate for their difficulty in getting it by laying their eggs on the closely appressed flowers. The wings of the males are clear, bright sulfur-yellow above; those of the females vary from yellow to cream, their outer margins brownish and with an orange-centered brownish ring in the discal cell of the forewing, most Puerto Rican individuals being of the pale form. In "A Revision of the Genus Phoebis (Lepidoptera)" (American Museum Novitates No. 368, pp. 22, many ref. New York, September 5, 1929), Mr. F. Martin Brown describes this pale female as *sennalba*, the type from Cuba, the paratype from San Juan, Puerto Rico: a form of *Phoebis eubule* Linnaeus of the West Indian race of *sennae* Linnaeus. The caterpillar is parasitized by the Chalcid wasp *Spilochalcis eubule* (Cresson).

Phoebis (Phoebis) argante (Fabricius), of which Mr. Wm. P. Comstock

(1944–506) describes the local subspecies under the name **martini,** was listed by all the earlier writers as a *Callidryas*. Dr. Wm. Schaus identified the bright yellow adult which was reared from a green caterpillar found feeding on the leaves of *Inga vera* at Cayey as *C. rorata* Butler: a female aberration of *argante* F., considered by Mr. Wm. P. Comstock (1944–508) as "confined mainly to Hispaniola." The ground color of the wings of the males is orange-yellow, with dashes of black at the ends of some of the veins; that of the females is dull yellow, often much mottled with reddish brown, and with brownish spots at the ends of some veins and towards the apex of the forewings. While it is possible that the caterpillars may feed on the leaves of some other host than the coffee shade tree, *Inga vera*, all adults have been collected in the coffee regions: Mayagüez, Añasco, Camuy, Adjuntas, Orocovis and Cayey.

Phoebis (Phoebis) agarithe (Boisduval), of which the Antillan race was described by Mr. F. Martin Brown (1929–15) under the name **antillia,** was listed as a *Callidryas* by Drs. Stahl, Dewitz and Gundlach and by Herr Möschler, Dr. Gundlach pointing out its differences from the preceding species. In Van Zwaluwenburg's list it is P. R. 1428. The AMC collection contains specimens from Yabucoa, La Plata and Mayagüez; Prof. J. A. Ramos has collected it at Lajas and at Cartagena Lagoon; and Mr. Cesario Pérez reared it from larvae on *Pithecolobium dulce* at La Muda, between Río Piedras and Caguas.

Phoebis (Phoebis) philea (Johansson) was listed from Puerto Rico by the earlier workers as *Callidryas thalestris* Hübner, which Mr. Wm. P. Comstock (1944–510) considers distinct. Herr Möschler (1880–94), presumably quoting Dr. Gundlach, notes "raupe auf Leguminosen: *Poinciana pulcherrima, Cassia fistula, grandis, occidentalis.*" Mr. F. Martin Brown (1929–9) gives many names in synonymy of this, the largest of the species of *Phoebis* which occurs in Puerto Rico, but apparently it is so rare that Mr. Comstock had only a single specimen: from Aibonito.

Phoebis (Rhabdodryas) trite (Linnaeus), of which Mr. F. Martin Brown described the Antillean race (1929–20) under the name of **watsoni,** the type from Santo Domingo, others from Cayey and Adjuntas, Puerto Rico, was listed as a *Callidryas* by all the earlier writers. Adults have since been taken at San Juan and Mayagüez.

Phoebis (Aphrissa) godartiana (Swainson) is listed from Puerto Rico by Mr. F. Martin Brown on page 5 of his "A Revision of the Genus *Aphrissa*" (American Museum Novitates No. 454, pp. 14, fig. 15. New York, Februry 9, 1931), altho no recent collection has been made here

Phoebis (Aphrissa) statira cubana d'Almeida was listed from Puerto Rico by Drs. Dewitz and Stahl as *Callidryas evadne* Hübner, and by Dr. Gundlach and Herr Möschler as *Callidryas statira* Cramer, the caterpillar

feeding on Cassias, and also by all of them as *Callidryas neleis* Boisduval, not in synonymy. Mr. F. Martin Brown (1931–7) indicates the synonymy of these and others, considering "*neleis* Boisduval must be restricted to the West Indian race." Mr. Wm. P. Comstock (1944–514) states that "*neleis* is confined to Cuba," and that the adult reared from larva feeding on tender leaves of "quenepa" (*Melicocca bijuga* L.) at Río Piedras "was determined erroneously by Mr. F. E. Watson." The confusion is more than a matter of names, for quenepa is not a Leguminous tree. Mr. Francisco Seín noted larvae on quenepa in November 1939, but from the chrysalids they formed, emerged only parasitic Chalcid wasps: *Spilochalcis eubule* (Cresson). It is apparent that the wasps are unselective as to the species of *Phoebis* attacked, and are not restricted to the species after which they are named. The adult sent to Mr. Watson was reared in July 1936, and caterpillars have been noted every year since on the same quenepa tree, feeding on the tender leaves. Adults appear every June, the females ovipositing as soon as the tender leaves appear, but no second generation of caterpillars develops on this particular quenepa. Is it possible that during the remainder of the year other generations of caterpillars feed on *Cassia*? The adults of "both sexes have a ground color of sulphur-yellow on both surfaces," the male having no color markings, the female only a few spots, mostly on the under surface.

Kricogonia castalia (Fabricius) is a comparatively rare butterfly in Puerto Rico at the present time, but it was listed by all the earlier writers, Dr. Dewitz using the generic name *Gonepteryx*. Dr. Gundlach gives an extensive synonymy, making no distinction between this species and *lyside*, but of *Rhodocera terissa* noting "una mancha quadrilonga negra extendida desde el borde anterior de las alas posteriores hacia el disco." He gives the distribution as Cuba, Jamaica, Florida and Texas, and states that it "vive más bien cerca de la costa que en el interior." Whether this implies that he noted a mass migration along the coast of Puerto Rico is uncertain, but such has been recorded from Haiti (Entomological News, **38** (4): 97–100. Philadelphia, April 1927), and it might well have occurred in Puerto Rico when the host plant of the caterpillars, lignum-vitae or "guayacán" (*Guaiacum officinale*), was more abundant than at present. Guayacán grows almost exclusively in the more xerophytic areas of the south coast of Puerto Rico, the collection by Mr. F. E. Watson from Quebradillas, reported by Mr. Wm. P. Comstock (1944–517), being most exceptional, while those from Lajas and Ensenada are to be expected. Mr. Cesario Pérez collected adults, as identified by Mr. W. D. Field, in January 1942 at Salinas, a very few of these black-lined specimens being distinguished by him among swarms of cabbage butterflies.

Kricogonia lyside (Laterille) is distinguished by Mr. Wm. P. Comstock

(1944–517) from *castalia* on the basis of larger size, "the black bar on the hindwing is usually narrower (1 mm. wide) and tends to obsolescence and disappearance," and on the underside of the hindwings "there is a raised line of dull yellow scales about 0.5 mm. wide." He admits, however, that "the male genital armature is indistinguishable." He identifies Puerto Rican specimens from Coamo, Guayanilla and Lajas.

Eurema (Eurema) daira ebriola (Poey), listed under this specific name from Puerto Rico by Drs. Stahl and Dewitz, is called *Terias jucunda* (Boisduval and LeConte) by Dr. Gundlach (with *ebriola* in synonymy); "La oruga se encuentra sobre el *Desmodium*." Mr. Wm. P. Comstock (1944–520) records collections from Puerto Rico at Mameyes, El Yunque and Coamo, and wide distribution in the other Antilles.

Eurema (Eurema) elathea (Cramer) has been reared from a little green chrysalis found on a *Zamia* leaf at Guánica Insular Forest, May 31, 1942. Mr. Wm. P. Comstock (1944–521) records collections at Ensenada, Tallaboa, Ponce and on El Yunque, as well as in many of the other Antilles.

Eurema (Eurema) palmira palmira (Poey) was listed from Puerto Rico by all the earlier workers as a *Terias*, Dr. Gundlach noting "su oruga sobre el *Desmodium*." It has been intercepted at Luquillo and Vega Baja, and Prof. J. A. Ramos (1947–53) collected these little black-margined yellow butterflies on Mona Island, of which the typical form occurs in most of the Antilles.

Eurema (Pyrisitia) dina (Poey) is represented in Puerto Rico, according to Mr. Wm. P. Comstock (1944–525) by the subspecies **sanjuanensis,** which Mr. Frank E. Watson described as "A new *Eurema* from Puerto Rico" (American Museum Novitates No. 971, pp. 2, New York, April 25, 1938): the holotype from San Juan.

Eurema (Pyrisitia) lisa euterpe (Ménétriés) was identified by Dr. Harrison G. Dyar for specimens collected by Mr. Thos. H. Jones at Río Piedras in 1912, and near Tortuguero Lagoon in 1914, forming the basis for the entry as a *Terias* in Van Zwaluwenburg's list: P. R. 135. This is one of the common butterflies of Puerto Rico, having been repeatedly intercepted along the north coast from Arecibo to Luquillo, and found in great abundance at Colonia Jauca, Salinas, by Dr. Luis F. Martorell in September 1939. As *Xanthidia lisa* Boisduval and LeConte (= *Terias sulphurina* Poey), it is listed by Dr. Gundlach, who notes its extensive distribution in the West Indies, continental United States and Canada, and that according to Boisduval, "la oruga vive en la *Cassia* y *Glycine*." Prof. J. A. Ramos (1947–53) records collecting adults on the plateau of Mona Island. "The males have a bright yellow ground color on both surfaces, while the females may vary from pale yellow to white. In both sexes, the apical and outer marginal area of the forewing on the upperside is black-brown. The

hindwing of the male has a black-brown border about 0.5 mm. wide," according to Mr. Wm. P. Comstock (1944–524).

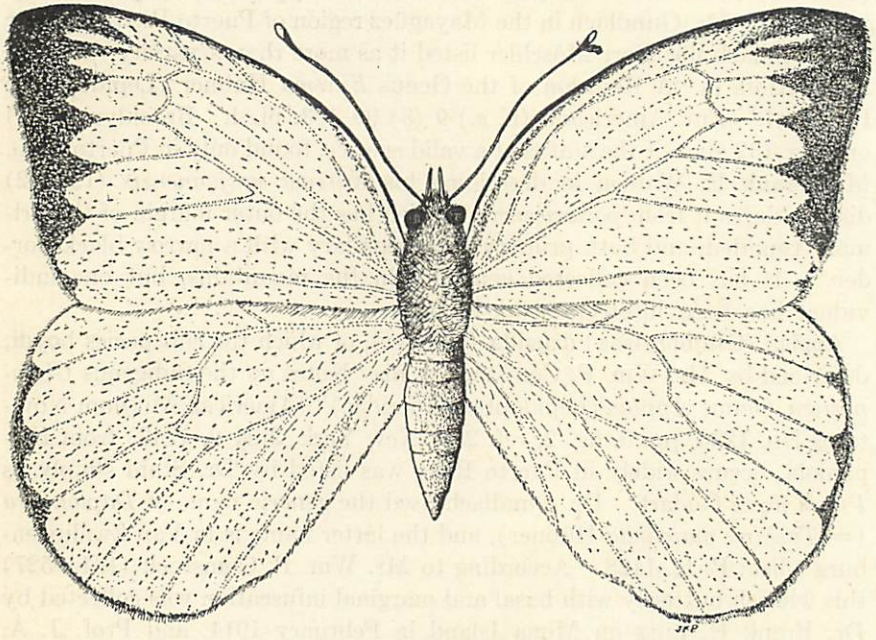
Eurema (Pyrisitia) nicippe (Cramer) is considerably larger than others of this genus, having deeply black bordered wings of bright orange. Mr. Wm. P. Comstock (1944–525) cites collections at Dorado and Indiera, and Prof. J. A. Ramos has additional specimens from Mayagüez.

Eurema (Pyrisitia) portoricensis was described by Dr. Hermann Dewitz (1877–237) as a *Terias citrina*, var. *nova* from type material presumably collected by Dr. Gundlach in the Mayagüez region of Puerto Rico. Neither Dr. Gundlach nor Herr Möschler listed it as more than a variety, but Dr. A. B. Klots in "A Revision of the Genus *Eurema* Hübner (Lepidoptera: Pieridae)" (Ent. Americana (n. s.) 9 (3) 99–163, pl. 4. Brooklyn, 1929) on page 132 gives it the status of a valid species, found only in Puerto Rico. Mr. Frank E. Watson in describing his *Eurema sanjuanensis* (1938–2) differentiates it from *portoricencis*, "which has the outer margin of the primary rounded, and both primary and secondary with a narrow black border." It has been collected generally in the mountains, but one individual has been intercepted at Manatí.

Appias (Glutophrissa) drusilla (Cramer), of which the subspecies **boydi,** described by Mr. Wm. P. Comstock in his "Notes on the Subgenus *Glutophrissa*, Genus *Appias* (Lepidoptera, Pieridae)" (American Museum Novitates No. 1236, pp. 6, fig. 2, ref. 25. New York, July 9, 1943) from Hispaniola, occurs widely in Puerto Rico, was listed by Dr. Stahl simply as *Pieris ilaire* Godart. Dr. Gundlach used the generic name of *Daptonoura* (= *Tachiris margarita* Hübner), and the latter name is in Van Zwaluwenburg's list: P. R. 1428. According to Mr. Wm. P. Comstock (1944–527) this whitish butterfly with basal and marginal infuscation was collected by Dr. Frank E. Lutz on Mona Island in February 1914, and Prof. J. A. Ramos (1947–53) found numerous others there thirty years later. In Puerto Rico this predominantly xerophytic butterfly is most abundant around Cartagena Lagoon and at Ensenada, but has also been collected at Quebradillas, Arecibo and even on El Yunque.

Appias (Glutophrissa) punctifera was described by Sr. R. Ferreira d'Almeida in his "Revisao do Género *Appias* (subgen. *Glutophrissa* Butl.)" (Bol. Biol., 4 (1): 50–66, pl. 2. Río de Janeiro, 1939) as a distinct and valid species for the four entirely white females with a prominent spot on the forewing, which Dr. Dewitz had considered hybrids or throwbacks of *Tachiris margarita* Hübner or *T. molpadia* Hübner (1877–234 and 245), and basing "his name on Dewitz' description and figures, apparently without specimens." Mr. Wm. P. Comstock (1943–5) redescribes both sexes, noting males from Orocovis and Coamo, and occurrence in St. Thomas and St. John of the U. S. Virgin Islands.

Ascia monuste (Linnaeus), the common white cabbage butterfly, is much better known as *Pieris*, under which generic name it was listed from Puerto Rico not only by the early systematic workers, but also by Mr. W. V. Tower (1908–35) as a pest of cabbage, radish, turnip, kale and mustard, by Mr. Thos. H. Jones (1915–6) on horse radish and *Cleome spinosa* (= *C. gynandra*), and by Dr. Richard T. Cotton (1918–281) who made fresh illustrations of egg, larva and adult from material reared on cabbage.



The Puerto Rican variety of the common Cabbage Butterfly, *Ascia* (or *Pieris*) *monusta eubotea* (Latreille), twice natural size. (The hind wings are not as large as here shown by José F. Pietri.)

Mr. Wm. P. Comstock (1944–529) notes that the typical continental subspecies, **A. m. monuste** (Linnaeus) may occur in Puerto Rico by migration, but the bulk of the insular population is **A. m. eubotea** (Latreille), mixed with and hybridized with **A. m. virginia** (Latreille), the common subspecies of the Lesser Antilles. The record of *Pieris joppe* Boisduval by the early workers refers to the subspecies *eubotea*. The hairy, greenish-yellow caterpillars feed not only on the leaves of common economic cruciferous crops, but Dr. Luis F. Martorell noted them on tender shoots of "burro" (*Capparis portoricensis* and *C. coccolobifolia*) in the mountains between Cayey and Salinas. The plant on which they were feeding at Indiera in January 1923 could not be identified, but in June 1937 they were enormously abun-

dant in all the cane fields from Guánica to Guayanilla, feeding on the weed "jazmín de río" (*Cleome gynandra*). Many pupated on cane leaves, yet but few butterflies emerged, for most of the chrysalids were brown with parasitism by *Brachymeria incerta* (Cresson). When this weed is completely devoured locally by the caterpillars, or weeded out, they complete their growth feeding on anything else available, in January 1940 on Mona Island the crop attacked being onions. Formerly the control of these caterpillars might pose a serious problem, for insecticides sprayed on cabbage did not adhere, and there was always the subsequent danger of later human consumption. One can obtain immediate results with DDT and chlordan and some of the other newer insecticides, which kill so promptly that their adhesion to the plant need be for only a few minutes to be effective.

Ascia (Ganyra) josephina Godart, of a variety collected from the south coast of Puerto Rico by Herr Leopoldo Krug, was described by Dr. Hermann Dewitz under the name of *Pieris josephina* var. **krugii** (1877–235). It was listed but not collected by Drs. Stahl and Gundlach, and by Herr Möschler. It is apparently confined to the more xerophytic southwestern corner of Puerto Rico, Prof. J. A. Ramos having found it at Lajas, June 13, 1942, according to Mr. Wm. P. Comstock (1944–532) who identified the specimen.

Papilionidae: The Swallowtails

Papilio polydamas Linnaeus, of which the local subspecies: **thyamus** Rothschild and Jordan, was described from St. Thomas, was listed from Puerto Rico by all the earlier workers, Dr. Gundlach, in addition to notes on continental distribution and in Cuba, states "la oruga se cría en especies de *Aristolochia*. Exhala un olor a almizcle." The local subspecies does not occur in the other Greater Antilles, but in the U. S. and British Virgin Islands, not in Lesser Antilles farther south. The adult is a fine large black, non-tailed butterfly, with a submarginal row of yellow darts and marginal crescents on the forewing, a submarginal row of greenish-yellow broad crescents and marginal crescents on the hindwings. Mr. Thos. H. Jones collected an adult near Laguna Tortuguero in July 1914; Prof. J. A. Ramos reared them at Mayagüez more recently, and Mr. Wm. P. Comstock (1944–533) records collections from San Juan, Santurce and Naguabo, with descriptions of the immature stages. Badly worn adults have repeatedly been noted on the beach at Mameyes, behind the protective margin of seagrape, visiting flowers of botoncillo and mingling with smaller butterflies.

Papilio aristodemus aristodemus Esper, originally described from Cuba as *Papilio Eques Achivus aristodemus* Esper, was listed from Puerto Rico by Drs. Stahl and Dewitz, and as *Papilio cresphontinus* Martyn by Dr.

Gundlach, with the other name in synonymy, and by Herr Möschler. Mr. Cesario Pérez collected one somewhat faded adult in October 1940 in what he called "Rexach": the hills beside Laguna San José which the stone-crushers are reducing to level land. Black-brown in ground color, the hindwing strongly tailed, both wings above bear a transverse yellow band and a submarginal row of yellow lunules, that on the forewing being bent at right angles towards the costa. Of the Floridian subspecies the larval host plant is torchwood (*Amyris elemifera*), according to Mr. Wm. T. Comstock (1944–536) quoting Miss Florence Moore Grinshawe's "Place of Sorrow" (Nature Magazine, **33:** 565. Washington, D. C., 1940).

Papilio androgeus Cramer, of which the local subspecies **epidaurus** Godman and Salvin was first identified from Puerto Rico by Mr. Frank E. Watson, was listed by Drs. Stahl, Dewitz and Gundlach as *Papilio polycaon* Cramer, the latter giving synonymy, and noting "su oruga se cría en especies del género *Citrus*." The caterpillar the "orange puppy" of citrus growers, is discussed as a minor pest of citrus in "An Economic Entomology of the West Indies" (1933–448), having been noted in Puerto Rico at Río Piedras, Manatí, Lares and Isabela, Mr. Wm. P. Comstock (1944–536) listing collections at Mayagüez, Maricao and Ponce. The adults are possibly the largest butterflies present in Puerto Rico, brownish-black and tailed, the males with a very broad yellow transverse band across both wings, the females with the forewings only in a limited area suffused with yellow, the hindwings extensively marked with greenish-yellow.

Papilio pelaus imerius Godart was listed as *Papilio pelaus* Fabricius by Drs. Stahl, Dewitz and Gundlach, the latter noting "he cogido una crisálida fijada en el tronco de un *Xanthoxylum*, y probablemente la oruga se cría en esta mata." In this supposition Dr. Gundlach was entirely correct, for larvae on "cenizo" (*Zanthoxylum martinicense*) have been noted at Martin Peña, Cayey and Barranquitas, and reared to adult. Even when fully grown the larvae are closely gregarious, crowding each other and hugging the trunk of the tree when not feeding, their purplish and greenish-brown bodies marked with extensive creamy spots and minor smoky areas, giving no indication when a lizard runs over the group, or an ant bites one. The adults are brownish-black, tailed butterflies, with a narrow transverse band across the forewings, marginal yellow crescents larger on the hindwings and submarginal orange crescents. One intercepted at Palo Seco was identified by Dr. Wm. Schaus as a new local race.

Hesperiidae: the Skippers

Phocides pigmalion pyres (Godman and Salvin), originally described from Hispaniola and Puerto Rico as *Erycides pyres* (1879–154), has not since been found outside of Hispaniola.

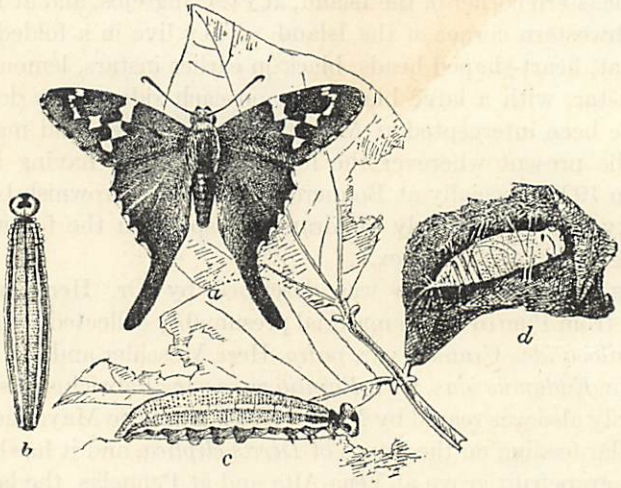
Polygonus lividus Hübner was originally described as *Papilio amyntas* Fabricius from America, and listed from Puerto Rico as a *Goniloba* by Drs. Dewitz and Stahl, and as *Hesperia amyntas* by Dr. Gundlach and Herr Möschler. Dr. Gundlach notes "he criado la oruga en *Lonchocarpus*," and in the Report of the Experiment Station at Mayagüez for 1937 (1938–93), the rearing of adults, determined by Mr. J. F. Gates Clarke as *Acolastus amyntas*, from larvae feeding on the leaves of semi-commercial plantings of *Derris eliptica*, is recorded. "Ventura" (*Ichthyomethia piscipula*) is the endemic host, larvae having been found at Cabeza de San Juan, in the northeastern corner of the Island, at Pt. Cangrejos, and at Boquerón, in the southwestern corner of the Island. They live in a folded-over leaf and have flat, heart-shaped heads, black in earlier instars, lemon yellow in the final instar, with a large black spot on each side of the dorsal cleft. Adults have been intercepted at Manatí and Mayagüez, and may be presumed to be present wherever the host plant grows, having been very abundant in 1923 especially at Boquerón. They are brownish-black, with three chalky white irregularly quadrangular spots on the forewings, and three smaller ones near the apex.

Proteides mercurius pedro was described by Dr. Hermann Dewitz (1877–242) from Puerto Rican material presumably collected by Dr. Gundlach as *Goniloba idas* Cramer, var. *pedro*. Herr Möschler and Dr. Gundlach use the name *Eudamus idas*, with *Papilio mercurius* Fabricius in synonymy. This butterfly also was reared by Mr. H. K. Plank at the Mayagüez Station, the caterpillar feeding on the leaves of *Derris eliptica*, and it has been intercepted in a grapefruit grove at Vega Alta and at Peñuelas, the latter being determined by Dr. Wm. Schaus as *Proteides jamaicensis* Skinner. It has four pale whitish spots in a row on the black-brown forewing, and three other smaller ones, with extensive basal orange cilia.

Proteides zestos Geyer was listed from Puerto Rico by Drs. Dewitz and Stahl as a *Goniloba*, and by Herr Möschler and Dr. Gundlach as *Aethilla anaphus* Cramer. According to Mr. Wm. P. Comstock (1944–544) the hyaline spots on the forewing are placed as with *P. m. pedro*, but are amber-colored. He lists numerous records from Puerto Rico, in addition to the interceptions at Cidra and Ponce, and notes distribution from Florida to Barbados.

Urbanus proteus (Linnaeus), listed by the earlier workers in Puerto Rico as a *Goniurus*, and in Van Zwaluwenburg's list (901), by Dr. C. W. Hooker (1913–14), Mr. Thos. H. Jones (1915–7) and Dr. Richard T. Cotton (1918–277) as an *Eudamus*, is a common but not especially abundant or economically important pest of beans and cowpeas. The caterpillars may also feed on the leaves of beggar weed (*Meibomia purpurea*), and an adult reared from the leaves of "bejuco de San Pedro" (*Stigmatophyl-*

lum lingulatum) at Loíza in 1923 is quite typical and indistinguishable from those of which the caterpillars fed on the normal hosts. It occurs in all parts of the Island, but despite its distribution "from the southern United States to Argentina and throughout the West Indies," according to Mr. Wm. P. Comstock (1944–545), it has not been found on Mona Island, the specimens collected there by Dr. Luis F. Martorell proving to be the following species. This long-tailed Hesperiid is characterized by the whitish hyaline spots on the forewings and by the extensive basal yellowish-blue-green iridescent sheen above.



The Bean Hesperiid, *Urbanus proteus* (Linnaeus): *a*, adult, *b* & *c*, larvae, *d*, pupa, all natural size. (After Chittenden, U. S. D. A.)

Urbanus dorantes Stoll, of which Mr. Wm. P. Comstock (1944–546) describes the local subspecies of the Virgin Islands, Puerto Rico, Mona Island and Hispaniola as **cramptoni**, was listed from Puerto Rico by the earlier writers as an *Eudamus*, and an intercepted adult from lime flowers at Dorado was identified by Dr. Wm. Schaus as *Eudamus santiago* Lucas. The amber hyaline spots of the forewings are "distinctly reduced in size," and none of blue-green iridescent sheen of *proteus* appears. Despite the abundance of adults nothing is known of the immature stages. Prof. J. A. Ramos (1947–54) found these butterflies abundant on Mona Island, and those collected there by Dr. Luis F. Martorell in earlier years in abundance on the flowers of "corcho" (*Pisonia albida*) and of "ángela" (*Moringa oleifera*), in most cases have had their tails broken off, but were identified by Mr. Comstock as being typical of his subspecies. Dr. Martorell notes that they were "the most common insect coming to feed on the nectar of fresh blossoms" of these plants.

Astraptes anaphus Cramer, of which the Antillean subspecies was described from St. Vincent and Grenada as *Telegonus anausis* Godman and Salvin, was listed from Puerto Rico by Drs. Dewitz and Stahl as a *Goniloba*, and by Dr. Gundlach and Herr Möschler as an *Aethilla*. The only recent collections are one by Mr. Miguel A. Díaz at Santurce, and one intercepted in a grapefruit grove at Vega Alta.

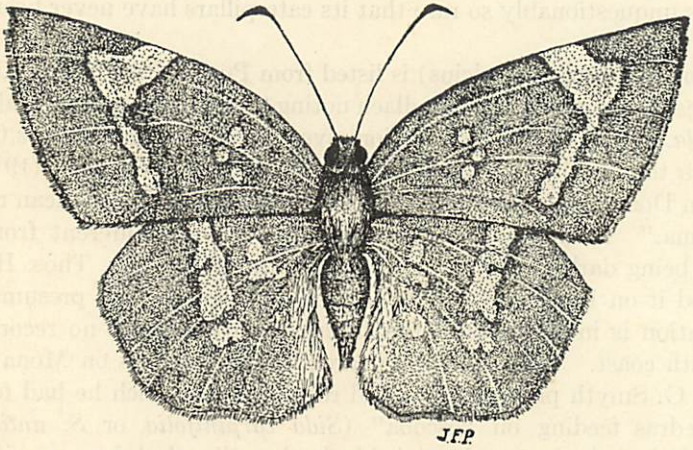
Astrapates talus (Cramer) is listed from Puerto Rico by Dr. Dewitz as a *Goniloba*, and by Herr Möschler and Dr. Gundlach as an *Eudamus*, the latter noting "la oruga se cría en *Guarea trichilioides*." This is "guaraguao": an important cabinet-wood tree. Mr. Wm. P. Comstock (1944–550) records the recent capture of two small males at Mayagüez, but it is unquestionably so rare that its caterpillars have never been noted by the foresters.

Pyrgus syrichtus (Fabricius) is listed from Puerto Rico under this name by the earlier workers, Dr. Gundlach noting "la oruga se cría en Malvaceas, v.g. *Sida*." Dr. Dewitz in addition gives the name *Pyrgus orcus* Cramer, of which the distribution, according to Mr. Wm. P. Comstock (1944–551) "is from Dominica southward—with an extensive South American range to Argentina." In appearance this Hesperiid is very different from most others, being dark grey with numerous white spots. Mr. Thos. H. Jones collected it on El Duque and at Laguna Tortuguero, and presumably its distribution is in all parts of the Island, altho there are no records from the south coast. Dr. Luis F. Martorell collected adults on Mona Island. Mr. E. G. Smyth photographed and reared larvae which he had found at Río Piedras feeding on "escoba" (*Sida carpinifolia* or *S. antillensis*). "The head of the mature larva is black, the collar dark brown, with three light spots, and the body yellowish green, thinly pilose. The pupa, about 15 mm. long, is bright reddish-brown, greenish on the anal segments and wing-cases, and thickly pilose." The "form **montivagus** Reakirt is as common as *syrichtus* in Porto Rico," according to Mr. Wm. P. Comstock (1944–551).

Pyrgus crisia crisia Herrich-Schäffer is listed from Puerto Rico by the earlier workers, but has not been collected recently.

Achylodes papinianus Poey, of which the local subspecies is described by Mr. Wm. P. Comstock (1944–552) from Dominica, Guadeloupe, the Virgin Islands and Puerto Rico under the name of **minor**, was listed as *A. thraso* Hübner by the earlier writers, although Dr. Gundlach is sure the species "no son ambos iguales." More recently it is called *Eantis*, and as *Eantis thraso* is in Van Zwaluwenburg's list (22) on orange, noted by Dr. Richard T. Cotton (1917–21) as "fairly common in some (citrus) groves," and in "Insectae Portoricensis" (1923–149) the larva and chrysalis are described, with record of the larvae found feeding on the leaves of "espino

rubial" (*Zanthoxylum monophyllum*) at Boquerón. It occurs in all parts of Puerto Rico, Prof. J. A. Ramos having specimens from Cartagena Lagoon, and larvae having been noted on wild orange at Indiera, Lares and Aibonito; on grapefruit at Isabela, Vega Alta, Pt. Salinas (Palo Seco) and Río Piedras. It is hardly an economic pest in mature grapefruit trees, but may become abundant in nurseries warranting a single application of arsenate of lead, as recommended in "An Economic Entomology of the West Indies" (1933–449). "Its head is large, prominent and heart-shaped, being attached to the body by such narrow segments as to appear as though carried on a neck. The light, yellowish-green body tapers to either end,



Adult of the Citrus Hesperiid, *Achylodes papinianus minor* Comstock, twice natural size. (Drawn by José F. Pietri.)

striped with dark green along the middle of the back and more broadly with bright yellow along the sides. Even when very small, it invariably bends over a bit of leaf to form a shelter, lined with silk, in which to live and feed. As the caterpillar grows larger, it forms an ever larger temporary shelter, eventually using an entire leaf. Within this structure, it transforms to a chrysalis, cloudy green in color and densely covered with whitish bloom. The adult butterfly is most disappointingly dull and prosaic in coloration: brown, mottled with somewhat ligher-colored lines and spots."

Ephyriades arcas (Drury), originally described from the Island of St. Kitts as a *Papilio*, was listed from Puerto Rico by Drs. Dewitz and Stahl as *Antigonus flyas* Cramer, and in addition Dr. Stahl lists *Nisoniades brunnea* Herrich-Schäffer, which Mr. Wm. P. Comstock states (1944–556) is confined to Cuba, and the nomen nudum *A. ptreus* Cramer. Dr. Gundlach gives a long synonymy, noting "la oruga se cría en especies de la familia de

las apocíneas, v. g. del género *Echites*." Apparently the female, so different in appearance that she has been named *Melanthes zepodea* Hübner, is not a discriminating botanist in the selection of a host on which to oviposit, for larvae have been reared feeding on the leaves of "bejuco de San Pedro" (*Stigmatophyllum lingulatum*) at Pt. Cangrejos, Loíza and at Boquerón; on "olaga" (*Malpighia fulcata*) at Maunabo; and on leaves of "ceiba" (*Ceiba pentandra*) at Salinas. In "Insectae Portoricensis" (1923–149), as a *Brachycorene*, the immature stages are described, and the record of so many adults reared that the identity of the velvety, dark brown male and the lighter brown female, with silvery spots on the forewings, is again proved beyond possibility of dispute.

Erynnis zarucco (Lucas), originally described from Cuba as a *Thanaos*, is listed from Puerto Rico by Dr. Stahl as *Nisoniades jaruco* Lefebvre (in Lucas) with *N. juvenalis* H. S. in synonymy.

Hylephila phyleus (Drury), originally described from St. Kitts and others of the Lesser Antilles, was listed from Puerto Rico by Dr. Dewitz as a *Pamphila*, by Herr Möschler and Dr. Gundlach as a *Hesperia*. It is in Van Zwaluwenburg's list as P. R. 130, and has been repeatedly intercepted since in all parts of humid Puerto Rico—a common little skipper of yellowish-orange and dark brown. Mr. E. Stuart Paton in "The Life-History of some Jamaican Hesperiidae" (Jour. Institute Jamaica, 2 (5): 435–441, pl. 1. Kingston, 1897) describes the habits of the greenish-brown larva, which burrows in the earth by day and comes out at night to feed on the grasses *Paspalum conjugatum* and *Panicum sanguinale*.

Polites dictynna (Godman and Salvin), identified as a *Thymelicus* by Dr. Wm. Schaus from a specimen intercepted in an orange grove at Pueblo Viejo. This may be what Dr. Stahl listed as *Goniloba cosinia* H. S., mistakenly in synonymy with *Thymelicus brettus* Boisduval.

Atalopedes mesogramma (Latreille), of which Mr. Wm. P. Comstock (1944–559) described the local subspecies under the name **apa**, was listed as a *Pamphila* by Drs. Dewitz and Stahl. Dr. Gundlach, following Herr Möschler, gives *Hesperia cunaxa* Hewitson in synonymy with *alameda* Lefebvre, this name also being given by Dr. Wm. Schaus to one of these little brown butterflies with extensive orange areas, collected by Mr. Thos. H. Jones in 1912, and to another intercepted at Villalba. The subspecies is quite common in the more humid areas of Puerto Rico and Hispaniola.

Wallengrenia otho (Smith & Abbot), of which Mr. Frank E. Watson in "New Hesperiidae from the Antilles (Lepidoptera: Rhopalocera)" (American Museum Novitates No. 906, pp. 10. New York, January 16, 1937) describes the new subspecies **mutchleri** from Puerto Rico, Mona and Desecheo Islands, St. Thomas and St. Croix of the Virgin Islands, and Hispaniola, was first listed from Puerto Rico by Dr. Dewitz as *Pamphilia*

druryi Latreille, and by Herr Möschler and Dr. Gundlach as *Hesperia druryi*. Indeed, the specimens collected here by staff members of the American Museum of Natural History and returned to Puerto Rico for record were labeled *Catia druryi* Latreille, but in "Insectae Portoricensis" (1923–151), the name *Catia otho* Smith and Abbot was used, the synonymy by Dr. Wm. Schaus. This little golden-brown skipper with orange spots was collected by Mr. Thos. H. Jones on El Duque, at Río Piedras and near Tortuguero Lagoon, and has since been intercepted in all parts of the Island, including Ponce, and on Mona Island by Dr. Luis F. Martorell on Sardinera Beach on March 30, 1940. In Puerto Rico the larva has not been noted, but in Santo Domingo it is "the smallest and most common Hesperiid caterpillar feeding on cane leaves, and also common on rice and other coarse-leaved grasses. The larvae are green with purplish-brown head, variably marked with silvery or greenish-yellow," as observed at Haina in 1921, and recorded under the name of *misera*: the Cuban subspecies.

Choranthus vittelius (Fabricius), first listed from Puerto Rico by Dr. Dewitz as a *Pamphila*, and by Dr. Gundlach and Herr Möschler as *Hesperia hübneri* Plotz, was identified as an *Atrytone* for Mr. Thos. H. Jones by Dr. Harrison G. Dyar, and this name has since been used for all records of the caterpillar as a minor pest of sugar-cane, Mr. E. G. Smyth (1919–143) mentioning also Sudan grass and other wild grasses as host plants. Mr. Jones noted that the larvae had twice been quite common on cane leaves at Río Piedras during the three years that he was in Puerto Rico, and apparently it was comparably abundant at the time that Mr. E. G. Smyth was conducting his tests on the transmission of mosaic disease. It has not been at all common since, not having been noted at all during the five year survey of eggs of sugar-cane moth-borer (1936–41). As observed by Mr. Jones, the caterpillar is 35 mm. long when fully-grown, with dull yellow, granular head banded with black, and robin's egg blue body, of nocturnal feeding habits, "resting by day in shelters of partly-eaten, folded-over leaves, held together with numerous strands of silk, in which, after filling in the ends with more silken strands, the opalescent, creamy yellow chrysalis is formed." "The adult is a small butterfly with brilliant, shining, chrome-yellow wings, margined with black, having an expanse of about 27 mm." This account was from his notes, published as "The Caterpillars which eat the Leaves of Sugar-Cane in Porto Rico" (Jour. Dept. Agr. P. R., 4 (1): 38–50, fig. 10. San Juan, January 1922). Adults have since been collected at Barceloneta and Cayey, and intercepted at Bayamón, Aibonito and Mayagüez, and others identified as *Atrytone portensis* Mabille by Dr. Wm. Schaus, intercepted at Bayamón and Arecibo.

Another Hesperiid larva reared on leaves of sugar-cane at Pt. Cangrejos

in 1920, about an inch long when fully-grown, its head "yellow with brown markings, its body opalescent grey-green, with two noticeable yellow spots on the twelfth segment dorsal and very short black hairs on the thirteenth segment," as reported in "The Minor Sugar-Cane Insects of Porto Rico" (Jour. Dept. Agr. P. R., 5 (2): 5–47, fig. 19. San Juan, April 1921), was identified by Mr. Carl Heinrich as possibly *Choranthus ammonia* Plotz, and later by Dr. Wm. Schaus as **Choranthus haitensis** Skinner.

Choranthus borinconus was described by Mr. Frank E. Watson as a *Godmania* (1937–9), the type from Aibonito, others from San Juan and Dorado, being the butterfly listed by Drs. Dewitz and Stahl as *Pamphila silius* Latreille, and by Herr Möschler and Dr. Gundlach as a *Hesperia*. Numerous interceptions of this butterfly have been made: at Ponce identified by Dr. Wm. Schaus as *Choranthus hesperia* Plotz, and at San Juan and Mayagüez as *Choranthus hübneri* Plotz, but as Mr. Watson had not described the female, it was not until Mr. Francisco Seín reared adults of both sexes from larvae feeding on the pinnae of areca palm that identification by Mr. J. F. Gates Clarke made possible the description of the male by Mr. Wm. P. Comstock (1944–563). They are quite different in appearance, the female having a ground color of "dark brown with ferruginous scaling" and yellowish subhyaline spots on the forewing, while the male is a shade of deep orange bordered with brown. The caterpillar differs from that of *C. vitellius* in that the four curving bands on the front of the head are dark brown ventrally, fading to dull orange above, only the thoracic half-collar black. As this is almost the only inset attacking the betel palm, *Areca catechu* L., it would be of considerable importance if at all abundant on such a popular ornamental.

Lerodea tripuncta (Herrich-Schäffer) is a little brown butterfly with three small white spots on the forewing, listed from Puerto Rico by Drs. Dewitz and Stahl as a *Cobalus*, and by Herr Möschler and Dr. Gundlach as a *Hesperia*. It has been intercepted on El Yunque, at Río Piedras, Quebradillas, Mayagüez and Ponce, apparently occurring in all parts of Puerto Rico, and collected on Mona Island by Dr. Luis F. Martorell, and by Prof. J. A. Ramos. According to Mr. Wm. P. Comstock (1944–566), "the larvae feed on Guinea grass and probably other grasses, pupation occurring in a cocoon formed of a rolled grass blade spun together with silk."

Calpodes ethlius (Cramer) was first noted in Puerto Rico by Dr. Gundlach. "La oruga se alimenta de las hojas de maranta y canna, y difiere por su forma, transparencia de la piel, y por la forma de la crisálida de las otras especies antillanas." It is number 1645 on Van Zwaluwenburg's list, and its abundance at Isabela was noted by Dr. M. D. Leonard (1932–127). Mr. John D. More vainly attempted control on the hedge of cannas

at the Union Club of Santurce during the summer of 1922. Control by DDT is now much simpler than when one was forced to use arsenate of lead, of poor adhesion to waxy canna leaves. For observing caterpillar internal anatomy these larvae are most useful, not only because of their almost perfect transparency but also because of their large size. The black-brown adults are possibly the largest Hesperiids in Puerto Rico, and may at once be distinguished by the whitish hyaline spots in the hindwing, three in number (two single and one double), as well as the much larger hyaline spots in the forewing.

Panoquina nyctelia (Latreille), identified for Mr. Thos. H. Jones as *Prenes ares* Felder by Dr. Harrison G. Dyar, is thus called in all the economic literature from the account in Jones and Wolcott (1922–41), illus-

Head and thorax of larva of *Panoquina nyctelia* (Latrielle), twice natural size. (Drawn by Thos. H. Jones.)

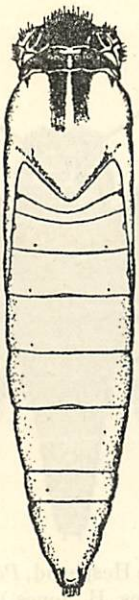
Front view of head of larva of *Panoquina nyctelia* (Latreille), twice natural size. (Drawn by Thos. H. Jones.)

trated by drawings of the front and side view of the head and chrysalis, almost to date. It is one of the more common Hesperiid caterpillars feeding on the leaves of sugar-cane in Puerto Rico. The adult may be most easily recognized by the largest of the white hyaline spots on the forewing being almost quadrangular, and the larva by the black collar on the dorsum of the neck.

Panoquina nero (Fabricius), of which Mr. Frank E. Watson described the local subspecies (1937–4) under the name of **belli**, was listed by Dr. Dewitz as a *Goniloba*, and by Herr Möschler and Dr. Gundlach as a *Hesperia*. Most unfortunately, the identification under this name by Dr. Harrison G. Dyar for the material collected by Messrs. D. L. Van Dine and Thos. H. Jones, referred to the next species, and all the economic notes under *nero*, including the drawings of larva, pupa and adult by Mr. Jones, are of *sylvicola*, a smaller but similarly marked species. The largest white hyaline spot on the forewing of *sylvicola* is shaped like a lop-sided arrowhead; that of *nero* has a very blunt point, but *nero* may most easily be recognized by the broad white transverse band on the underside of the hindwings, barely perceptible above. The Río Piedras collection contains one specimen collected by Mr. Thos. H. Jones on El Duque on March 9, 1914, which Dr. Wm. Schaus in 1923 had tentatively identified as "near *corrupta* H. S. of Cuba, appears peculiar to P. R. and is probably undescribed," and two others from Río Piedras, but Mr. Wm. P. Comstock

(1944–569) lists many other localities, including Adjuntas, Mayagüez and Ensenada, indicating island-wide distribution.

Panoquina sylvicola (Herrich-Schäffer), of which Mr. Frank E. Watson described the local subspecies (1937–6) under the name of **woodruffi**, was listed from Puerto Rico by Drs. Dewitz and Stahl as a *Goniloba*, and by Herr Möschler and Dr. Gundlach as a *Hesperia*. The larva is the most common Hesperiid caterpillar to be found attacking cane leaves, but in "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields"

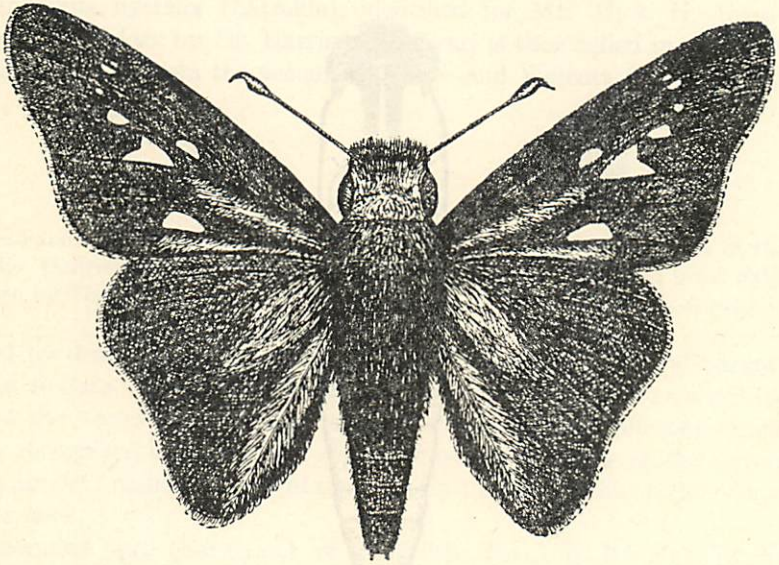


Pupa of *Panoquina nyctelia* (Latreille), twice natural size. (Drawn by Thos. H. Jones.)

(Jour. Agr. Univ. P. R., 27 (2): 95–104, fig. 12, ref. 16. Río Piedras, June 1944) its complete absence from April to September is recorded, due to total parasitizm by *Oöencyrtus prenidis* Gahan of the eggs. As *Prenes nero* Fabricius (due to original misidentification by Dr. Harrison G. Dyar) it is number 319 in Van Zwaluwenburg's list, and is repeatedly mentioned by Messrs. D. L. Van Dine, Thos. H. Jones and E. G. Smyth as a pest of sugar-cane, the most complete account appearing from the notes of and with the original illustrations by Mr. Jones (1922–39). From the larvae he reared the parasites which Mr. C. F. W. Muesbeck described as *Apanteles prenidis*, and also *Ardalus antillarum* Gahan, and noted direct attack by the

paper-nest wasp, *Polistes crinitus* Felton. Only *Trichogramma minutum* Riley was reared from the eggs by Mr. Jones during the years 1912 to 1914, altho recently the only egg-parasite was *Oöencyrtus*.

Panoquina ocola (Edwards) was reared in 1912–13 by Mr. Thos. H. Jones from larvae eating the leaves of sugar-cane and *Hymenachne amplexicaulis*, but he left no description of them. Apparently they were so similar to those of *P. sylvicola* as to be unrecognized as distinct until the adults appeared. Indeed, the adults also are quite similar, being somewhat smaller,



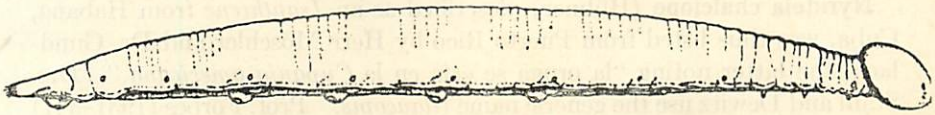
Adult of the common Sugar-Cane Hesperiid, *Panoquina sylvicola woodruffi* Watson, twice natural size. (Drawn by Thos. H. Jones.)

with smaller spots. They have repeatedly been intercepted from various points along the north coast, but there are no records of occurrence in xerophytic Puerto Rico.

Panoquina panoquinoides panoquinoides (Skinner) is the smallest of the genus in Puerto Rico, according to Mr. Wm. P. Comstock (1944–571), of which "the small, yellow hyaline spots of the forewing correspond in position with those of *ocola*, but they are frequently obsolete and sometimes absent."

Perichares phocion phocion (Fabricius), listed from Puerto Rico by Drs. Stahl and Dewitz as *Goniloba corydon* Fabricius, and by Herr Möschler and Dr. Gundlach as *Hesperia corydon*, the latter noting "la oruga se cría en varias gramíneas de hoja no pequeñas, pues se esconde entre ellas reunidas

con su seda como todas las orugas de esta familia," is a minor pest of sugar-cane, being number 308 on sugar-cane in Van Zwaluwenburg's list. "Conspicuous because of its size and hairiness, being entirely green with broad greenish-yellow dorsal stripe and long white hairs, caterpillars or pupae were found only from September to April, and only on the north coast: Coloso to Mameyes. One fully grown caterpillar, possibly attempting to pupate, was found being eaten by crazy ants, *Prenolepis longicornis* Latreille," during the five years 1936–1941 in which young cane was examined for egg-clusters of *Diatraea saccharalis*. In January 1922 caterpillars were noted on cane at Guánica, Arecibo and Toa Alta, possibly marking a period of exceptional abundance. Distribution is island-wide, Mr. R. G. Oakley having intercepted adults at Ponce. Typical adults have two larger amber hyaline spots in the forewing, and two small ones, which, in the males are inside the points of a crescent of grey scales.



Larva of the common Sugar-Cane Hesperiid, *Panoquina sylvicola woodruffi* Watson, twice natural size. (Drawn by Thos. H. Jones.)

HETEROCERA: Moths

Prof. Wm. T. M. Forbes of Cornell University has most recently treated the "Heterocera or Moths (excepting the Noctuidae, Geometridae and Pyralidae) Insects of Porto Rico and the Virgin Islands" (Scientific Survey of Porto Rico and the Virgin Islands, N. Y. Academy of Sciences, **12** (1): 1–171, pl. 2, ref. 52. New York, 1930). To this he added a "Supplementary Report on the Heterocera or Moths of Porto Rico" (Jour. Dept. Agr. P. R., **15** (4): 339–394, pl. 6. San Juan, November 1931) that is also reprinted as a supplementary part of Volume 12 of the Scientific Survey. His nomenclature and order of listing are followed in this account. To him the writer is most greatly indebted for a final reading of the MS as it was being printed. He rechecked all the locality records and added innumerable notes on nomenclatorial and other changes.

Euchromiidae (Syntomidae, Amatidae)

Phoenicoprocta parthenii (Fabricius), a clear-wing moth with red tegulae, was first listed from Puerto Rico by Dr. Dewitz as *Glaucopis multicincta* Walker, as a *Poecilosoma* by Herr Möschler and Dr. Gundlach. It was identified as a *Mallodeta* by Dr. Wm. Schaus: a specimen collected in 1912 at Río Piedras by Mr. Thos. H. Jones, and also by Dr. Harrison G. Dyar:

a specimen collected by Mr. E. G. Smyth at Hda. Santa Rita, Guánica. Prof. Forbes (1930–20 and 1931–341) lists collections at Aguadilla, Isabela and Coamo, and it has been intercepted at Bayamón.

Phoenicoprocta capistrana (Fabricius) has "tegulae solidly colored: yellow, or black and blue, not red." It was listed by all the earlier entomologists as *Glaucopis selecta* H. S., and in "Insectae Portoricensis" (1923 156) as a *Bombiliodes*, but the only recent collection is a specimen in the AMC collection: from Coamo.

Eunomia columbina (Fabricius), listed by the earlier entomologists as *Glaucopis insularis* Grote, was reared by Dr. Gundlach, who notes "la oruga en las convolvulaceas." Prof. Forbes (1930–22) lists a specimen from Maricao, which "leans a litle toward *rubripunctata*," and it is as **Eunomia rubripunctata** Butler that Mr. J. F. Gates Clarke identified the specimen which Dr. Luis F. Martorell collected at light on Mona Island.

Nyridela chalciope (Hübner), described as an *Isanthrene* from Habana, Cuba, was thus listed from Puerto Rico by Herr Möschler and Dr. Gundlach, the latter noting "la oruga se cría en la *Cupania americana*." Drs. Stahl and Dewitz use the generic name *Glaucopis*. Prof. Forbes (1931–341) lists specimens collected by Mr. Francisco Seín at Lares.

Cosmosoma auge (Linnaeus), originally described as a *Sphinx*, is the largest and most abundant of the clear-wing moths of Puerto Rico, brilliant with "abdomen blue dorsally, orange on sides," to quote from Prof. Forbes (1930–23). Drs. Dewitz and Stahl list it as *Glaucopis omphale* Hübner, and Herr Möschler and Dr. Gundlach use this specific name, the latter noting "la oruga se cría en la Mikania." It has been reared from a cocoon on a leaf of "cedro" (*Cedrela mexicana*) at Cayey, and adults have been collected at light from numerous points in the more humid parts of the Island, from the coast to El Yunque.

Cosmosoma achemon (Fabricius), var. **tyrrhene** Hübner, listed by Drs. Dewitz and Stahl as a *Glaucopsis*, according to Prof. Forbes has the "abdomen orange dorsally; blue on sides." Adults have been collected from numerous points in the more humid parts of the Island.

Lymire flavicollis (Dewitz), described (1877–94) as an *Echeta* from Puerto Rico, is a small greyish moth with plumose antennae, a yellowish collar, its wings entirely covered with scales. Drs. Dewitz and Stahl also list from Puerto Rico the Cuban *Echeta albipennis* H. S., and Dr. Wm. Schaus determined one unlabeled specimen from Puerto Rico as the Jamaican *Lymire melanocephala* Walker, listed in "Insectae Portoricensis" (1923–157). Prof. Wm. T. M. Forbes, in his "Notes on West Indian Syntomidae and Arctiidae (Lepidoptera)" (Bull. American Museum Nat. Hist., **37** (14): 339–345. New York, 1917), on page 345 redescribes the local species under the name of *Lymire senescens*, the type from Naguabo,

but later (1930–24) indicates its syononymy and the characters by which the other West Indian species may be recognized. Several adults have been collected at light on El Yunque, but others are from Mayagüez and Coamo, and one was reared from a cocoon intercepted on a cucumber leaf at Caguas.

Horama panthalon (Fabricius), originally described as a *Zygaena*, was listed from Puerto Rico by all the earlier entomologists, and at times may be exceedingly abundant. On January 9th, 1923, Mr. Francisco Seín collected in his hand eight adults at Boquerón, resting on leaves of "malvavisco" (*Waltheria americana*). They are narrow winged, brownish moths, with compactly plumose antennae, the abdomen banded with yellow, their prominent yellow-scaled hindlegs with distal third of tibia black. Altho Dr. Stuart T. Danforth had specimens from Tortuguero Lagoon, all other collections are from southwestern Puerto Rico: Añasco, Mayagüez, San Germán, Boquerón, Guayanilla, and Ponce to Aguirre and Guayama.

Horama pretus (Cramer), originally described as a *Sphinx*, was listed by all the earlier entomologists and is P. R. 151 in Van Zwaluwenburg's list. It has a wingspread of an inch and a half, its wings opaque with chocolate brown scales, its antennae with a black club and terminal yellow hook, yellow collar and metathorax, first segment of the abdomen mostly grey, the second laterally yellow, others above velvety brown. This strikingly beautiful moth has an equally brightly-colored larva, described in "Insectae Portoricensis" (1923–157) as "bright reddish-orange, reddest on thorax and head, shining, 15 mm. long, 7 mm. wide when fully grown; body with numerous spreading tufts of grey and white hairs, curved towards their tips; on the seven anterior abdominal segments dorsally are four compressed tufts of black hair in pairs, bending towards each other, the anterior pair of each segment closer together and touching at apex." They live in silken nests, webbing together leaves of "cocorrón" (*Elaeodendron xylocarpum*) and spinning cocoons of thin grey silk with longer hairs of the larva entangled in it, the pupa itself being a bright reddish brown in color. Larvae have been noted at Pt. Cangrejos, Manatí, Arecibo and Boquerón, and adults, altho sometimes attracted to lights at night, as at Río Piedras and Guánica, are more often noted on flowers in the daytime, as at Pt. Salinas, Boquerón and on Vieques Island.

Empyreuma pugione (Linnaeus), originally described as a *Sphinx* from St. Thomas, more nearly resembles a tarantula-hawk (*Pepsis rubra*) in color and general appearance, if not in habits and character. Listed from Puerto Rico by all the early entomologists, Dr. Gundlach notes "oruga en *Nerium*" and indeed oleander appears to be the only host of the larva. Listed as *E. lichas* Cramer by Mr. R. H. Van Zwaluwenburg under number

1634, he described (1916–45) the eggs as "round, yellow, brown before hatching, slightly iridescent, sculptured with dull sheen, regularly spaced in groups on under side of leaf. Larvae dull orange, hairy, with silvery lateral stripes. Larval stage 26 days, pupal stage 13 days. Adult has crimson wings and dark blue body." Locally, the hairy caterpillars may become a serious pest on individual oleander bushes, occurring in all the more humid parts of the Island. It has been definitely recorded from Mayagüez, Aguadilla, Isabela, Arecibo and Bayamón, with many records in the San Juan metropolitan area.

Correbidia terminalis (Walker), originally described as *Euchromia* (*Pionia*), was listed from Puerto Rico as *Charidea cimicoides* H. S. by all the earlier entomologists, Dr. Gundlach noting "la oruga vive en la cara inferior de las hojas de *Cecropia*, formando luego un capullo poco primoroso." This black and red banded moth is an inhabitant of the hurricane forest and the coffee groves, Prof. Forbes reporting recent collections on El Yunque and at Lares, and additional specimens have been taken at light on El Yunque and at El Verde subsequently.

Correbidia bicolor (Herrich-Schäffer), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Charidea*, is considered by Prof. Forbes (1930–27) as "possibly an extreme light form of the preceeding, from which it appears to differ only in color," being mostly orange.

Nolidae

Celama sorghiella (Riley), originally described as a *Nola*, was re-described from Puerto Rico by Herr H. B. Möschler (1889–118) as *Nola portoricensis*. It is a minute whitish moth with some pale brown and blackish scaling, occurring, according to Prof. Forbes (1930–28), in the southern United States to northern South America, Argentine, rare or absent in tropical South America. As the caterpillars feed on the arrows of sugar-cane, this peculiar distribution, paralleling that of the culture of sugar-cane, is quite obvious. The small hairy, yellowish caterpillars, with pink lateral stripes and dark yellow heads are at times enormously abundant in sugar-cane arrows, and may even eat the pupae of those developing most rapidly. Dr. Wm. Schaus identified the reared adults, as well as numerous others intercepted at light at Bayamón.

Nola bistriga, described by Herr H. B. Möschler (1890–119) as a *Stenola* from Puerto Rico, is re-described by Prof. Forbes (1930–29) from a female from El Yunque as having a wingspread of 20 mm., "white, lightly sprinkled with black, with two nearly straight and parallel black lines across the wing." Mr. Francisco Seín found an additional female at Lares.

Nola sinuata is described by Prof. Wm. T. M. Forbes (1930–29), the types

all females from Coamo, "expanse 16 mm., forewing dull white, lightly dusted with fuscous and some blackish scales."

Arctiidae: Woolly Bears

Lycomorphodes strigosa (Butler), originally described as a *Trichromia*, was re-described from Puerto Rican material by Herr Möschler (1890–114) under the name of *Lycomorpha fumata*. It has not since been found in Puerto Rico.

Progona pallida was described as a *Delphyre* from Puerto Rican material by Herr H. B. Möschler (1890–118): a grey moth with black costal margin. It is quite common according to Prof. Forbes (1931–342), who lists collections at San Germán, Lares, Dorado, Cayey and on El Yunque. Numerous specimens were intercepted at light at Bayamón, Dr. W. A. Hoffman found it as El Semil, and Don Julio García-Díaz (1938–96) lists it, presumably collected on El Yunque.

Agylla sericea (Druce) was re-described by Herr Möschler (1890–117) from a single Puerto Rican specimen under the name of *Gnophria limpida*. It has not since been found locally.

Paramulona albulata (Herrich-Schäffer), originally described as a *Mieza*, and thus listed from Puerto Rico by Drs. Stahl and Dewitz, has not since been found locally.

Mulona nigripuncta Hampson, is "whitish with some fifteen black dots and an orange dot near end of cell," according to Prof. Forbes (1930–33), the type having been from Colombia. Herr Möschler and Dr. Gundlach presumably had specimens, listed as *Cincia conspersa* Walker. Prof. Forbes (1931–342) notes collections at San Germán, Palmas Abajo and Lares. Repeated interceptions have been made at light at Bayamón, and at San Juan.

Afrida charientisma Dyar, listed by Herr Möschler, Dr. Gundlach and in "Insectae Portoricensis" (1923–158) as *Afrida tortriciformis* Möschler, is reported from El Yunque by Prof. Forbes (1930–34). It has been repeatedly intercepted at light at Bayamón, and was collected by Dr. W. A. Hoffman at El Semil, and by Mr. Francisco Seín at Lares.

Eupseudosoma floridum Grote was listed from Puerto Rico by all the early entomologists as *E. nivea* H. S., Dr. Gundlach noting "la oruga en *Psidium*." Several of the beautiful brown hairy caterpillars with yellow heads were found feeding on leaves of guava at Río Piedras in April 1921, and reared to the satiny white adults, their abdomens, and in the males the inner margin of the hind wings, being suffused with pink. Dr. Richard T. Cotton had found larvae on guava at Caguas and reared adults in 1916, and Prof. Forbes (1930–34) also lists *Eugenia* as a host plant for the larva and records collections at Lares and Mayagüez.

Ammalo insulata (Walker), originally described as a *Halesidota*, was listed from Puerto Rico by all the early entomologists as *Pareuchaetes cadaverosa* Cramer and *P. affinis* Grote, not in synonymy, Dr. Gundlach noting "la oruga vive en *Vernonia*, *Eupatorium*." It is an entirely pale yellowish moth, except for a line of black spots on the dorsum of the abdomen, found in all parts of the Island from Guánica to Aibonito, Bayamón and Pt. Cangrejos, and collected by Dr. Luis F. Martorell at light on Mona Island. Prof. Forbes now calls it **Tanada insulata** (Walker).

Phegoptera bimaculata was described by Dr. Hermann Dewitz (1877–95) as a *Halisidota* from a single specimen from Puerto Rico, of which no subsequent specimen has been found locally.

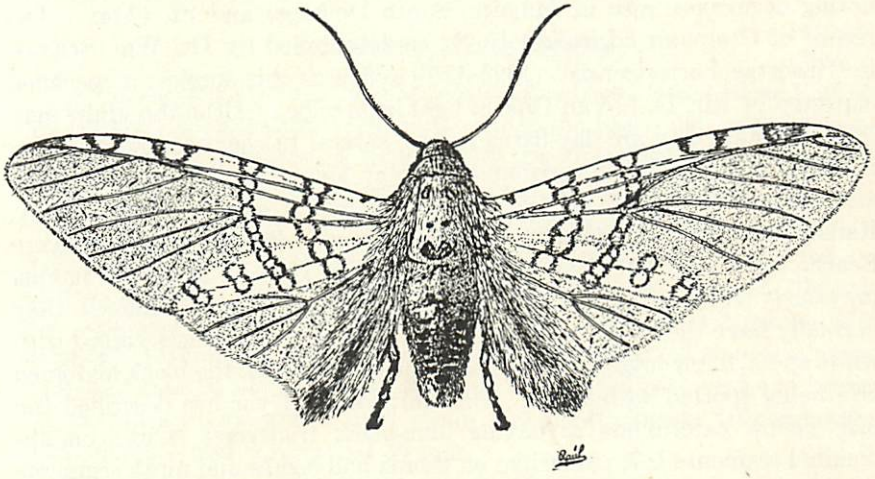
Microdota hemiceras was described by Prof. Wm. T. M. Forbes (1931–343), the type from San Germán, another from Coamo: a clay-colored moth, translucent, dusted with fuscous, with a wing expanse of 16 mm.

Halysidota cinctipes Grote was first recorded from Puerto Rico by Dr. Dewitz, and as *Halisidota tesselaris* Hübner listed by Herr Möschler, Dr. Gundlach noting "la oruga vive probablemente en Hibiscus." Prof. Forbes (1930–36) after describing the black and red-brown caterpillar, "clothed with gray-brown general hair and largely white pencils," states that "it eats *Coccoloba*." An adult was collected by Mr. Francisco Seín at Lares in December 1930, and another in July 1931.

Calidota strigosa (Walker), originally described as a *Sychesia*, was listed from Puerto Rico as a *Halisidota* by all the earlier entomologists. It is a large moth, thorax and forewings whitish striped with brownish-black, its abdomen light pink above, laterally spotted with black, not common in Puerto Rico, but found in abundance on Mona Island. According to Prof. Forbes (1930–37) its range includes the Greater Antilles and southern United States; "caterpillar on *Guettarda elliptica*; red-brown with shining black head."

Ecpantheria icasia icasia (Cramer), originally described as a *Bombyx*, was listed from Puerto Rico by all the earlier entomologists, who also gave the name *E. eridane* Cramer, not in synonymy. In Van Zwaluwenburg's list this was *E. eridanus* Cramer, number 1630, reared from *Erythrina micropteryx*, *Ipomea* sp, orange and banana, with the note "synonym of *E. icasia*: reared from the same egg-cluster and mated." In his "Notes on the Life History of *Ecpantheria eridanus* Cramer" (Insecutor Inscitiae Menstruus, 4 (1–3): 12–17. Washington, D. C., January–March 1916), Mr. R. H. Van Zwaluwenburg gave an extended account of this common woolly bear caterpillar which he found attacking also vanilla and *Cissus sicyoides*, describing all stages and noting *Eremotylus angulatus* Hooker as a parasite of the larva. In subsequent reports of the Mayagüez Station (1938–93, 1940–25 and 1943–29), it has repeatedly been noted as a pest on

vanilla. Dr. Richard T. Cotton (1918–285) records the attack of the caterpillars on stalks of celery, but actually they are almost omnivorous feeders in the garden, having been noted on beans, lima beans, tomato and eggplant, as well as on *Solanum torvum* and other weeds. The red-headed, black caterpillar, covered with stiff black hair, may be eaten with impunity by the crested lizard, *Anolis cristatellus*, and apparently relished, for three have been found devoured by the same lizard. Egg-clusters have been noted on *Psidium guajava* and *Cederela mexicana*, from one of which hatched 2,450 caterpillars. The adult is a large whitish moth with diagonal rows of brownish rings on the forewings, of which collections have been made in all parts of the Island, from El Yunque and Jájome Alto to Guánica and Isabela.



Adult of the Woolly Bear Caterpillar, *Ecpantheria icasia icasia* (Cramer), twice natural size. (Drawn by Raúl Maldonado.)

Utetheisa ornatrix ornatrix (Linnaeus) and **U. o. stretchii** (Butler) represent in Puerto Rico merely two color phases of the same species, of which the typical form has pale pink forewings with but a few scarlet dots only, while *stretchii* has forewings mostly cochineal pink, with prominent black spots. Listed from Puerto Rico by Dr. Dewitz as a *Deiopeia*, by Dr. Stahl as a *Callimorpha*, Dr. Gundlach gives all these names and *Utetheisa bella* Linn., noting "el colorido varía muchísimo, y por esto existen dos nombres. Muy común en los campos, la oruga se cría en *Crotalaria*." The scantily hairy, black and yellow banded caterpillars feed primarily inside the ripening pods of *Crotalaria*, and but rarely on the foliage, preferring the smooth pods of *retusa* to the hairy ones of *incana*. They void their excrement

outside the pods, and normally eat all the green seeds in a pod, leaving it clean and empty, with only the round hole for entrance and exit. They are often sufficiently abundant to cause appreciable losses when *Crotalaria* is being grown for seed production, but are of negligible importance when it is only for a cover crop or for green manure, and there is no record of an attempt being made at chemical control. The beautiful but rather weak-flying and helpless moths have been found in all parts of the Island and have an extensive neotropical distribution, a discussion of their races and variations being given by Prof. Forbes (1930–39 and 1931–343).

Pericopidae (Hypsidae in part)

Composia sybaris (Cramer), originally described as a *Phalaena*, was listed from Puerto Rico by all the earlier entomologists, Dr. Gundlach noting occurrence also in Jamaica, Santo Domingo and St. Croix. The record of *Composia fidelissima* H. S., as determined by Dr. Wm. Schaus, in "Insectae Portoricensis" (1923–179), refers to this species: a specimen captured by Mr. D. L. Van Dine at light in Arecibo. Altho the adults may come to light, they are day-flying moths, several having been noted flying in the bright sunlight in a coconut grove at Mameyes in November 1922, and feeding at flowers of "cariaquillo" (*Lantana camara*). Prof. J. A. Ramos reports (1947–44) them on "the flowers of *Pisonia albida* at Uvero Beach, April 4–7, 1944" on Mona Island, Dr. Luis F. Martorell having previously collected them at light on Sardinera Beach. Indeed they normally have the habits and appearance of a butterfly; black winged with white spots, a few bright red ones near the anal margin, the black abdomen also being spotted with white. Dr. Harrison G. Dyar has described the pale yellow caterpillars as having blue-black transverse stripes on abdominal segments 1–7, red stripes on thorax and eighth and ninth segments of abdomen; head red, as are also legs and anal plate; black hair, with four long white hairs on mesothorax and eighth segment of abdomen.

Ctenuchidia virgo Herrich-Schäffer, of which Prof. Wm. T. M. Forbes described the local race under the name of **virginalis** (1930–42), the type from Maricao, others from Indiera, is a black moth with plumose antennae, marked with orange on abdomen and at base of forewings, spotted with white; the hindwings extensively suffused with blue or blue-green iridescence. This was identified by Dr. Harrison G. Dyar as *Composia subcyanea* Walker, as listed in "Insectae Portoricensis" (1923–179): an adult found resting on grass and weeds in an abandoned coffee grove at Indiera, in the mountains north of Yauco. Mr. Jorge Serralés in May 1941 collected one on El Yunque at light, indicating island-wide distribution in the higher mountains.

Hyalurga (or **Lauron**) **vinosa** (Drury) was listed from Puerto Rico by

all the early entomologists, Dr. Gundlach noting "la oruga en *Tournefortia* y *Heliotropium*." In "Some Notes on the Habits and Life History of *Lauron vinosa* Drury" (Insecutor Inscitiae Menstruus, **2** (7): 108–11. Washington, D. C., 1914) Mr. Thos. H. Jones described all stages, reared by him at Río Piedras, and his record is in Van Zwaluwenburg's list as P. R. 123: on *Heliotropium indicum*. The caterpillars have also been intercepted at Bayamón on "cotorillo" (*Schobera angiosperma*), and indeed the dark fluttery adults may be expected wherever any Borraginaceus host plant grows. Most of the hind wing is semi-transparent, as is the base of the forewing, which is surrounded by a triangle of dull orange, with a prominent transverse white band across the apex. Prof. Forbes (1930–42) records collection by Mr. Aug. Busck on Culebra Island, and adults have been intercepted by Mr. R. G. Oakley at Ponce.

Agaristidae (Phalaenoididae)

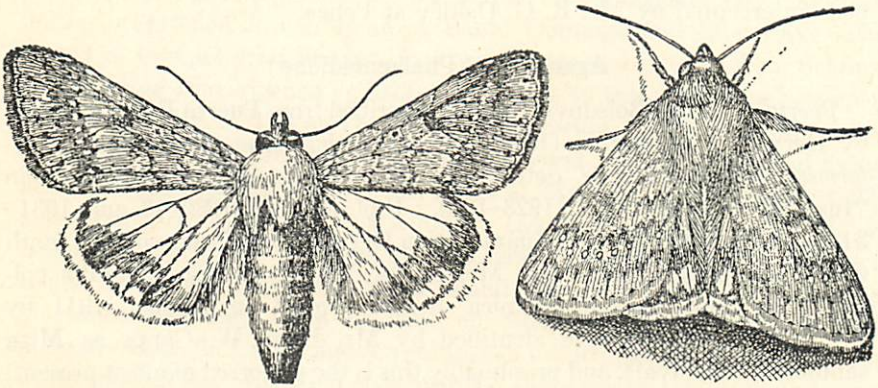
Tuerta sabulosa (Boisduval) was re-described from Puerto Rican material by Herr H. B. Möschler (1890–112) under the name of *Agarista noctuiformis*, and as a *Tuerta*, determined by Dr. Wm. Schaus, was listed in "Insectae Portoricensis" (1923–160). Prof. Forbes (1930–43 and 1931–344) records collections at Guánica, San Germán and Coamo of this moth which also occurs from New Mexico to Central America. Adults collected at light in the Guánica Insular Forest in August 1941 by Mr. Norberto Lugo were identified by Mr. Hahn W. Capps as **Misa sabulosa** (Boisduval), and presumably this is the preferred name at present. The light-colored fore wings are speckled and barred with scales of brown; the base of the hind wing is light yellow, the broad, sharply defined margin, dark brown; total wingspread 36 mm.

Noctuidae: Millers, Cutworms or Armyworms

Dr. William Schaus in writing the "Moths of the Family Noctuidae" (Scientific Survey of Porto Rico and the Virgin Islands, **12** (2): 175–290. New York, June 7, 1940) has provided a most modern systematic outline which will be followed in presenting the biologic notes on the members of this family, many of which are of major economic importance.

The American **Heliothis obsoleta** (Fabricius): the corn earworm, the tomato fruitworm and the cotton bollworm of the United States, in the latest list of "Common Names of Insects Approved by the American Association of Economic Entomologists" (November 14, 1946) is called **Heliothis armigera** (Hübner), of which it is an original homonym. It was thus listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "en las mazorcas del maís y en las cápsulas del algodón." Using one name or the other it has been noted or discussed at length by every

subsequent economic entomologist as a serious pest of corn, and a minor pest of beans, peppers, tomatoes, tobacco buds and seed pods, eggplant, peas, pigeon peas, and most recently attacking sunflower heads. Noted by Mr. L. Courtney Fife (1939–6) as not attacking cotton locally, caterpillars were abundant feeding within bolls at Isabela in 1950: the first record on this host since that of Dr. Gundlach. Even as a pest of the ears of corn its occurrence can by no means always be anticipated. But in the growing of sweet corn at the Mayagüez Station it proved to be a major pest, in the control of which Mr. B. A. App in "A Report on some Investigations of Corn Insects in Puerto Rico" (Jour. Agr. Univ. P. R., **25** (4): 21–31. Río Piedras, April 7, 1942) used hog rings, paper caps, string and wires. In



Adult of the Corn Earworm, *Heliothis obsoleta* (Fabricius), twice natural size. (After Quaintance, U. S. D. A.)

the next few years, however, the use of pyrethrum extract in mineral oil proved to be such an outstanding success in the United States as entirely to displace such make-shift remedies. Against attack by these viciously-biting caterpillars on other vegetables no such obvious remedy is available. Most of the larvae noted in Puerto Rico are bright yellow, marked with dark brown and black, the adults showing little variation from the standard pattern of light yellowish-brown forewings, the hindwing deeply margined with dark brown. Of its economic status, Dr. Schaus (1940–180) merely notes: "larva on corn, tobacco buds, tomatoes, etc."

Heliothis (or **Chloridea**) **virescens** (Fabricius) is not listed by Drs. Stahl and Dewitz from Puerto Rico, but Dr. Gundlach states "la oruga es muy dañina, principalmente al tabaco, pues vive en el cogollo y luego también en las cápsulas. Lo mismo en las cápsulas de *Hibiscus*, *Sesamum* y otras plantas. Una oruga que llevaba en la mano me mordía puesta con otras orugas se las comía." There is no record of attack on tobacco since

that of Dr. Gundlach, but Mr. John D. More did rear this greenish moth from cotton at Sabana Llana in 1922, and Mr. L. Courtney Fife (1939–6) records finding the larvae abundant on *Abutilon hirtum* at Guánica, Lajas and Boquerón in November 1935. It is mainly a pest on pigeon peas, however, being in Van Zwaluwenburg's list as number 1627: on *Cajan cajan*, and thus noted or discussed by Messrs. Richard Faxon & C. P. Trotter (1932–446), by Dr. Mortimer D. Leonard (with A. S. Mills 1931–473, 1932–136 and 1933–122) and finally by the latter (1931–119) as eating cowpea pods. Up to 1935, thirty interception records of finding these caterpillars in pigeon peas had been made: at Isabela, Aguadilla, San Sebastián, Las Marías, San Germán, Ensenada, Peñuelas, Ponce, Juana Díaz and Aguas Buenas.

Agrotis malefida (Guenée), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Argotis submucosa* H. S., is listed by Dr. Schaus (1940–180) as having been collected on Vieques Island, and at Ensenada and San Germán, the "larva a general feeder."

Agrotis subterranea (Fabricius) was listed from Puerto Rico by the early entomologists as *Argotis annexa* Treitschke, Dr. Gundlach noting "La oruga vive durante el día al pie de plantas tiernas, y sale al oscurecer para comer el tronco tierno. Causa daño en las huertas." This dirty brown cutworm, commonly known as "cachazudo" in Cuba, and "cuerudo" in Puerto Rico, is a serious pest of tobacco, and of it an extensive account is given in "Los gusanos de la Hoja del Tabaco" (Circular No. 53, Est. Expt. Insular, Río Piedras, pp. 1–15, fig. 8, pl. 1. San Juan, October 1922), and in "An Economic Entomology of the West Indies," pages 554 to 557, under the name of *Feltia annexa*.

In large part because of its ready availability, this cutworm was used in experiments "On the Amount of Food Eaten by Insects" (Jour. Dept. Agr. P. R., **9** (1): 47–58, ref. 6. San Juan, 1925), which indicated that tobacco leaves are 60% digestible by the larva, and that one eats "3.746 gr. of fresh tobacco leaves (or .5244 gr. dry), or 8.2 times as much as the weight of the adult." Altho normally a pest of tobacco in Puerto Rico, the caterpillars may attack other crops, as alfalfa at Fajardo in 1913, of which the adult was determined by Dr. Harrison G. Dyar, and cucumbers at Río Piedras in 1937. The year 1937 also marked an epidemic outbreak of these caterpillars at Boquerón where they destroyed three successive plantings of cotton, as related by Mr. L. Courtney Fife (1939–6). Moths have been collected at light at many points of Puerto Rico, not only in the tobacco regions of the mountains but also at Ponce and Guánica, and by Dr. Luis F. Martorell and Prof. J. A. Ramos (1947–45) on Mona Island. They are but little more attractive in appearance than the cater-

pillars, the forewings being a faded purplish-brown, with a lighter submarginal band and along the basal two-thirds of the costa.

Agrotis apicalis Herrich-Schäffer was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but has not since been collected locally.

Argotis repleta Walker, as determined by Dr. Harrison G. Dyar, was reared by Mr. Thos. H. Jones in February 1912 from a "larva found under clod of dirt in section where *Laphygma* and *Remigia* were abundant" feeding on young cane leaves at Río Piedras.

Anicla infecta (Ochsenheimer) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Agrotis incivis* Guenée, and appears on Van Zwaluwenburg's list as number 1509: on millet, grass, seed cane. Mr. E. G. Smyth collected a dozen adults at light at Hda. Santa Rita in 1913, as determined by Dr. Harrison G. Dyar, and they have been repeatedly intercepted at light at Bayamón. They are light purplish-grey above, speckled with black scales, with a fat c-shaped mark towards the center of the forewing. The small caterpillars found attacking very young cane leaves in the greenhouse at Río Piedras were green except for a broad chalky white stripe along the side of the body just above the legs, but older ones tended to be brownish or yellowish; the chalky white stripe becoming light orange in color, margined with light yellow. In the brown caterpillars this continuous stripe from head to anus, just below the spiracles, is entirely yellow or yellow brown, with sometimes two or more small black marks just beneath most of the spiracles. The fully-grown larvae pupated on the surface of the soil, making little attempt at forming a cocoon. Dr. Schaus (1940–182) notes the occurrence of this species "throughout tropical America."

Tiracola plagiata (Walker) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Agrotis grandirena* H. S., but has not since been found locally.

Lacinipolia parvula (Herrich-Schäffer) was listed as a *Mamestra* from Puerto Rico by the early entomologists, Herr Moschler (1880–135) noting "Raupe an *Solanum torvum*." During the summer of 1916, Mr. Eugene G. Smyth repeatedly reared this from larvae on *Solanum torvum*, and collected adults at light at Río Piedras and Isabela. Dr. Schaus (1940–183) lists collections from Mameyes and Coamo. The moth is rather small for a Noctuid, the forewings gray-brown transversely banded with dark brown.

Eriopyga adjuntas was described by Dr. Wm. Schaus (1940–184) from a single male from Adjuntas, with a wing expanse of 24 mm., its forewings mostly "buffy brown."

Xanthopastis timais (Cramer), form **antillium** Dyar, was listed from Puerto Rico by all the early entomologists, Dr. Gundlach "la oruga se alimenta de las hojas y cebollas de amarillideas." It is number 1684 in

Van Zwaluwenburg's list: on *Hibiscus rosa-sinensis* and *Xanthosoma*. The caterpillars are often a serious pest on the leaves of the white spider amaryllis or "lirio" (*Hymenocallis declinata*) of the beaches of the north coast, on the red amaryllis or "amapola" (*Hippeastrum puniceum*) of the fields, in gardens attacking duendes and other cultivated kinds of amaryllis, as well as tuberoses at times, being gregarious and often entirely destroying all aerial portions of the plants. The adults, often attracted to light, have hairy, dark brown thorax, wings mostly lavender in color, with brown areas and spots, and smaller spots or points of yellow. The larvae have bright yellow heads, dark purplish bodies with yellow spots, soft and watery. They are rapidly and very effectively controlled with DDT dust, applied directly to the caterpillars themselves.

Leucania chejela (Schaus), originally described from Guatemala, is listed by Dr. Schaus (1940–185) from Cuba, Jamaica and Puerto Rico.

Leucania hampsoni is the new name proposed by Dr. Wm. Schaus (1940–185) for what Herr Möschler and Dr. Gundlach listed from Puerto Rico as *Leucania clarescens* Hampson: a Cuban species not found locally. Specimens in the American Museum of Natural History were collected at Coamo Springs. For this and the other species of *Leucania* Dr. Schaus uses the generic name *Cirphis*, and this is the name most often used in the economic literature, especially for the sugar-cane feeding species: *latiuscula*.

Leucania humidicola (Guenée) was listed by Dr. Wm. Schaus (1940–186) from Coamo, and identified by Mr. J. F. Gates Clarke for Dr. W. A. Hoffman: specimens collected at light at El Semil, Villalba.

Leucania jaliscana (Schaus), originally described from Mexico, Central and northern South America, is listed by Dr. Schaus (1940–185) from Cuba, and from San Juan, Cataño, Toa Baja, and Guánica in Puerto Rico.

Leucania latiuscula (Herrich-Schäffer), listed from Puerto Rico by the early entomologists as a *Leucania*, and in addition re-described by Herr Möschler (1890–141) from local material as *Leucania punctifera* and *Leucania senescens*, is a minor pest, in Van Zwaluwenburg's list number 2010, on sugar-cane and grasses. It is listed or discussed by Mr. D. L. Van Dine (1913–257, 1913–33), by Mr. Thos. H. Jones (1914–462), and by Mr. E. G. Smyth (1819–144), but the most extensive account as a pest of sugar-cane is in Jones and Wolcott (1922–43). It is parasitized by a Tachinid, *Compsilura oppugnator* Walton, the Braconid, *Apanteles marginiventris* Cresson and a species of *Euplectrus*. Mr. R. A. Vickery in his "Observations on *Cirphis latiuscula* H. Sch. in the Gulf Coast Region of Texas" (Jour. Agr. Research, **32** (12): 1099–1119, fig. 3, ref. 14. Washington, D. C., June 15, 1936), under "Economic History" on page 1100, gives a summary of the Puerto Rican records up to that time. It would appear that the larvae were much more abundant on sugar-cane in 1911 to 1913 than at any later period, for they were collected in large numbers in all the coastal, sugar-

cane growing regions of the Island during those years, and many adults noted at light, at Río Piedras, and at Guánica. In recent years adults have twice been intercepted at light at Bayamón, but were not noted in a five year (1936–41) survey of the cane fields of the Island, Dr. Schaus (1940–186) citing only collection by Prof. Forbes in 1939 from Vieques Island. The caterpillars vary considerably in ground color from pinkish and yellowish to light grey-brown; and are surprisingly similar in color, granulation and texture of skin to dying or dead cane leaves, altho they live and feed on normal, healthy green leaves. The adults are yellowish, creamy moths, their forewings finely and lightly striped with darker scales and a submarginal row of small darker spots.

Leucania inconspicua (Herrich-Schäffer) was listed from Puerto Rico by the earlier entomologists and as a *Cirphis* Dr. Schaus (1940–187) lists more recent collections from Cataño, Toa Baja, Coamo and Adjuntas.

Leucania microsticha Hampson, listed by Drs. Stahl and Gundlach as *Leucania secta* H. S., and by Herr Möschler (1880–141) as *Leucania commoides* Guenée: "Raupe auf gräsern," was listed by Dr. Schaus (1940–186) from Toa Baja, and has been intercepted at light at Bayamón, as identified by him.

Leucania phragmitidicola (Guenée), listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–187) from Coamo and Guayama, as a *Cirphis*.

Leucania unipuncta (Haworth), the common armyworm of temperate zones, was listed from Puerto Rico by the early entomologists as *Leucania extranea* Guenée. Mr. Thos. H. Jones reared it to adult from larva on grass in the winter of 1912, and the following summer Mr. E. G. Smyth collected six adults at light at Hda. Santa Rita, Guánica, all identifications by Dr. Harrison G. Dyar, but it has not since been found locally.

Meliana rosea (Möschler) is identified by Dr. Wm. Schaus (1940–187) from Ensenada and Coamo.

Magusa orbifera (Walker), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Laphygma angustipennis* Möschler, is identified by Dr. Schaus (1940–188) from Cataño, and at Ensenada "both normal form and ab. *divida*."

Speocropia scriptura (Walker), re-described from Puerto Rico by Herr H. B. Möschler (1890–131) under the name of *Polyphaenis nona*, has not since been found locally according to Dr. Schaus (1940–188).

Cropia infusa (Walker), listed from Puerto Rico as *Decalea infusa* Walker by Herr Möschler and Dr. Gundlach, has not since been found locally, according to Dr. Schaus (1940–189).

Perigea albigera Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, has recently been collected at Coamo, Aibonito and Ensenada, according to Dr. Schaus (1940–190).

Perigea apameoides Guenée, listed from Puerto Rico by the early entomologists as *Perigea subaurea* Guenée, was collected at light at Hda. Santa Rita, Guánica, by Mr. E. G. Smyth, and repeatedly intercepted at light at Bayamón. Dr. Schaus (1940–190) lists collections at seven Puerto Rican localities, and on St. Thomas, and occurrence from the United States to Argentina. The adult has a white spot in the middle of the variegated bronzy-brown forewing.

Perigea concisa (Walker), as identified by Mr. Frank E. Watson for moths collected by Mr. E. G. Smyth at light at Hda. Santa Rita, Guánica, has since been repeatedly intercepted at light at Bayamón, and Dr. Schaus (1940–191) records the attack of caterpillars on cotton at Mayagüez, as well as collection of adults at Coamo and Arecibo.

Perigea circuita Guenée was listed by the early entomologists from Puerto Rico, and unlabeled specimens have since been determined from there.

Perigea cupentia (Cramer) was listed from Puerto Rico by Dr. Stahl as *P. infelix* Guenée, and by Dr. Gundlach and Herr Möschler as a *Craniophora*. Mr. E. G. Smyth reared the caterpillars, "green mottled with cinnamon brown," from "salvia" (*Pluchea purpurascens*) in the summer of 1916 at Río Piedras, as did also Mr. Francisco Seín in 1923, and Mr. A. S. Mills at Pt. Cangrejos. The adults have dark hindwings, and forewings of "cinammon brown" mottled with mauve, and have been taken at light at Río Piedras and intercepted at Bayamón. Dr. Schaus (1940–189) lists collections at Lares and Aibonito. An exceptionally light-colored specimen found dead on the window ledge of the laboratory at Río Piedras in March 1945, identified by Mr. Carl Heinrich as *Condica cupentia* (Cramer), is quite different. Prof. Forbes notes that Mr. J. G. Franclemont considers that two species are combined under this name. He labels *cupentia* the bluish one with strongly mottled wings: material from St. Thomas; he calls the Puerto Rican species with a large area of nearly smooth cream or clay color *epopea* Cramer.

Perigea selenosa Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *P. stelligera* Guenée, is identified by Dr. Schaus (1940–191) from San Germán, noting that it "has the white discal spot large."

Perigea sutor Guenée, as identified by Mr. Frank E. Watson for Mr. E. G. Smyth: moths which he had reared during the summer of 1916 from green caterpillars feeding on "salvia" (*Pluchea purpurascens*) at Río Piedras, was subsequently intercepted at light at San Juan and Bayamón, and Dr. Schaus (1940–191) lists collections at Naguabo, Coamo and Ensenada. These moths have almost no markings on their plain brown forewings.

Perigea punctirena (Walker), listed as a *Hadena* from Puerto Rico by Herr Möschler and Dr. Gundlach, has not since been found locally.

Cobaliodes tripunctus Hübner was listed by Dr. Dewitz (1877–243) from Puerto Rico.

Eriopus floridensis Guenée, as determined by Dr. Schaus, was reared in the summer of 1922 from a fern at Río Piedras; a light green caterpillar when small, striped with lighter green, but in the last instar dark brown, with stripes of light yellow on either side of the back. It was first listed from Puerto Rico as *Eriopus elegantulus* H. S. by Herr Möschler, Dr. Gundlach noting "criado en *Aspidium*." Adults have since been intercepted at light at Bayamón. Dr. Schaus (1940–192) notes that it occurs in Florida and tropical America, and (in correspondence) that it "sometimes attacks ferns in greenhouses." Prof. Forbes adds that it actually straggles as far north as Binghamton, New York.

Eriopus jamaicensis Möschler, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–192) from Lares.

Agripodes jucundella, as one of "New American Moths and Notes," was described by Dr. Harrison G. Dyar, the type from Indiera, Puerto Rico (Insecutor Inscitiae Menstruus, **10** (10): 8–18. Washington, D. C., 1922), reared by Mr. Francisco Seín from a grey-green and dark brown caterpillar feeding on lichens of trees in the hurricane rain forest. It formed a thin, tough cocoon in the lichen, and the emerging moth has forewings light green, marked with black and white, the hind wings grey. Dr. Schaus (1940–193) lists collection of adults at Aibonito.

Cephalospargeta elongata was described by Herr H. B. Möschler (1890–120) from Puerto Rican material collected by Dr. Gundlach and listed by him. Dr. Schaus (1940–193) records one recent collection from Guánica.

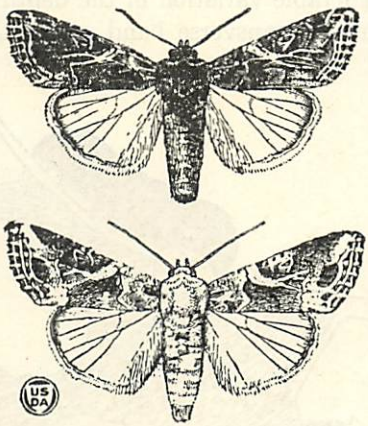
Metaponpneumata rogenhoferi was described by Herr Heinrich B. Möschler (1890–159), the type from Puerto Rico. Some small gray-brown moths collected by Mr. E. G. Smyth at Hacienda Santa Rita, Guánica in the summer of 1913, identified by Dr. Harrison G. Dyar as *Prorachia* (*Eumestleta*) *daria* Druce, are this species. Dr. Schaus (1940–194) lists collections from Coamo and Guayama, and Prof. Forbes from Aguirre.

Catabena esula (Druce) is identified by Dr. Wm. Schaus (1940–194) from Coamo, Guánica and San Germán. Mr. J. F. Gates Clarke identified for Dr. Luis F. Martorell these practically unmarked grey moths, their clear hindwings margined with brown, which he found in abundance at light on Mona Island, at the lighthouse and at Sardinera Beach. Prof. J. A. Ramos (1947–45) also found them abundant on Mona.

Catabena vitrina (Walker), listed as *Callierges divisa* H. S. from Puerto Rico by Herr Möschler and Dr. Gundlach, has recently been collected at both Guánica and Aguirre according to Dr. Schaus (1940–194). Extending straight across its grey fore wings from base to the middle of the margin is a narrow black stripe, paralleled near the margin by short stripes.

Prodenia androgea (Cramer) was listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga vive durante el día al pie de una planta tierna y de noche sale de la tierra a comer. Hace mucho daño en las huertas y otras tierras cultivadas, pues troncha los renuevos. Come de muy diferentes plantas." Dr. Schaus (1940–196) questions the correctness of this identification, altho "in the U. S. National Museum (is) a female from an old Porto Rican collection . . . , also a specimen from Cuba."

Prodenia dolichos (Fabricius), listed from Puerto Rico as *P. commelina* Smith and Abbot by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–195) from Coamo and Ensenada, and Prof. Forbes collected it on Vieques.

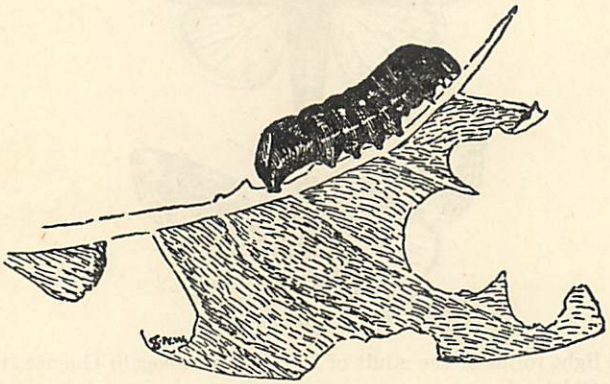


Dark and light forms of the adult of *Prodenia ornithogalli* Guenée, twice natural size. (After Chittenden.)

Prodenia latifascia Walker, listed as *P. testaceoides* Guenée by the earlier entomologists, is in Van Zwaluwenburg's list as number 912 on tomato. A cutworm attacking tobacco at Caguas in May 1921 was reared to adult, determined as this species by Dr. Wm. Schaus, and based on this instance are the records of it as a pest of tobacco. Another individual, which ate nearly twice as great a weight of tobacco leaves (6.697 gr.) as the common "cuerudo" (*Feltia subterranea*) in attaining full size, died in pupating. The adults have pinkish-purple, semitransparent hind wings, and a complicated pattern in the male of yellowish-brown on the forewings, with a large oval lighter area near the center towards the costal margin. Prof. Forbes points out that "the female is dull brown mixed with whitish, with very little yellow at inner margin, or none."

Prodenia ornithogalli Guenée, listed as *P. eudiopta* Guenée from Puerto Rico by Herr Möschler and Dr. Gundlach, was noted by Mr. Thos. H.

Jones (1915–8) as having been reared by him "from larvae found feeding on a weed of the family Convolvulaceae." Mr. E. G. Smyth collected eight adults at light, as identified by Mr. Frank E. Watson, during the summer of 1913, finding them "rather rare at light but a common species in the garden." This black cutworm, marked with golden triangles and a lateral band of yellow, preferably feeds on tobacco leaves, usually from the lower side, but has been noted on the upper side in full sunshine. Cuban tobacco growers call it "matequilla," but locally in Puerto Rico it is "casimir." It has also been noted feeding on the fruits of eggplant, tomato and pepper, and in 1942 and 1944 was observed on cowpeas at Loiza. Mr. E. G. Smyth records the caterpillars feeding on roses, and at the Mayagüez Station (1938–59) they "seriously damaged garden peas on Las Mesas." The adults show considerable variation in the depth of coloration on the forewings, but the curved transverse band across the forewing is quite constant.



Larva of *Prodenia ornithogalli* Guenée on tobacco leaf. Natural size. (Drawn by G. N. Wolcott.)

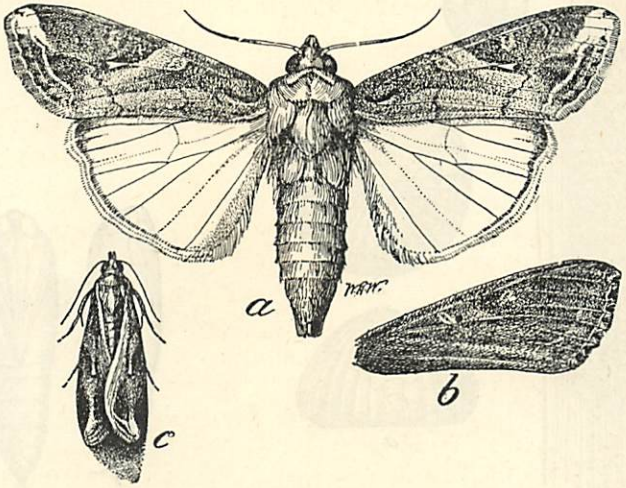
Prof. Forbes questions the occurrence of *ornithogalli* in the West Indies, tho it is common as far south as Florida. "*P. latifascia* is very like it, except the longer wings, and is sexually dimorphic in the same way: the female with more diagonal pattern, the male with a good deal of straw yellow about the middle of the wing. Aside from the longer or shorter wings, the best way to tell them apart is probably the brown terminal area which is markedly widened opposite the cell between M_1 and M_2, veins 5 and 6, in *ornithogalli*, but not widened in *latifascia*."

Prodenia pulchella Herrich-Schäffer, listed from Puerto Rico by the earlier entomologists, has been collected at Río Piedras, Naguabo and Coamo according to Dr. Schaus (1940–195), and intercepted at light at Bayamón.

Prodenia rubrifusa Hampson was identified by Dr. Wm. Schaus from

material intercepted at light at Bayamón, and collections at Coamo, Río Piedras and Lares are noted by him (1940–195).

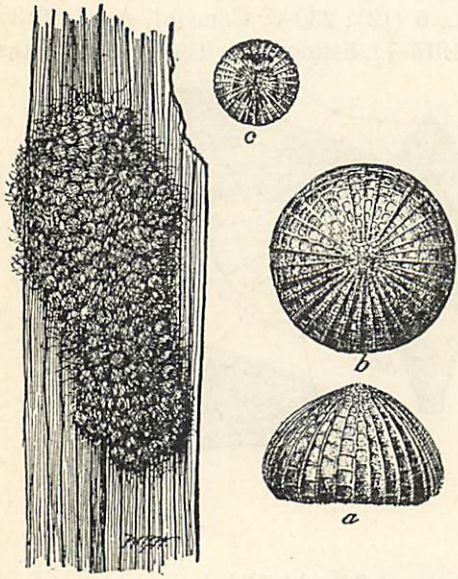
Laphygma frugiperda (Smith and Abbot) was listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga daña a veces las siembras de maíz, caña y otras," and in Van Zwaluwenburg's list is number 912 on sugar cane in seed beds, on *Panicum* sp. Listed and discussed as a pest of sugar-cane by Mr. D. L. Van Dine (1913–13 and 1913–257) and Mr. E. G. Smyth (1919–143), the most extensive account of this grassworm is that by Mr. Thos. H. Jones in "Some Notes on *Laphygma frugiperda* S. & A. in Porto Rico" (Jour. Ec. Ent., 6 (12): 230–6, Concord, April 1913), and as a pest of corn and onions (1915–7), listing three Tachinid parasites,



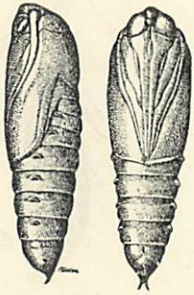
Laphygma frugiperda (Smith & Abbot). Adult with folded wings (*c*) is natural size. (Drawn by W. R. Walton, U. S. D. A.)

one wasp, three predators and two fungi. The record of attack by *Spicaria* (*Botrytis*) *rileyi* and *Empusa sphaerosperma* given by Mr. J. R. Johnston in "The Entomogenous Fungi of Porto Rico" (Bulletin No. 10, Board Commissioners of Agr. P. R., pp. 1–33, pl. 9, fig. 1. San Juan, 1915) is quoted by Mr. J. A. Stevenson (1918–207) and by Miss Vera K. Charles (1941–729). The caterpillars are also eaten by the lizards *Ameiva exsul* and *Anolis pulchellus*, and at the Mayagüez Station (1938–102), Mr. W. K. Bailey noted that they were attacked by three species of paper-nest wasps. Despite all these factors of natural control the fall armyworm or southern grass worm continues to be the major cutworm pest of young sugar-cane, corn, fruit of tomatoes, green pods of beans, eggplant, pepper, onions, alfalfa and many grasses. It has been found burrowing into gladiolus bulbs, and also attacking small eucalyptus seedlings. It has been noted burrow-

ing into the ground to eat the sprouting eyes of sugar-cane seed-pieces. The eggs are laid in clusters covered with hair from the body of the female, sometimes on the leaves of the plant to be eaten, but quite as often on vegetation, such as the pinnae of the areca palm which can not be eaten by the small caterpillars, or on inert objects, such as posts or stones or clods of earth, from which the just hatched caterpillars must migrate before they have anything but their own empty egg-shells to eat. "It is doubtful if a single field of corn ever reaches maturity in the West Indies without



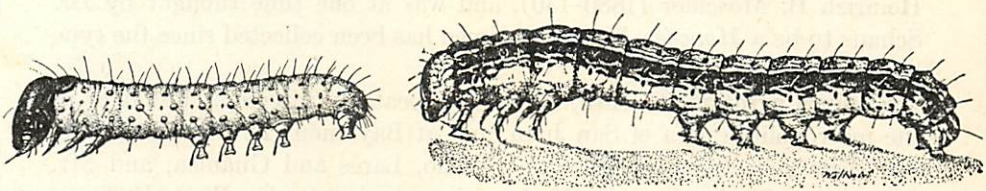
Egg-mass of *Laphygma frugiperda* (Smith & Abbot), twice natural size, and *a*, single egg from the side, *b*, from above, greatly magnified, and *c*, just about to hatch. (Drawn by W. R. Walton, U. S. D. A.)



Pupae of *Laphygma frugiperda* (Smith & Abbot), from side and from below, twice natural size. (Drawn by W. R. Walton, U. S. D. A.)

being attacked by *Laphygma*, and most corn suffers constant reinfestation." Attack on some vegetable crops can not similarly be predicted with certainty, and damage, as in the case of eggplant fruit, lima beans, and tomatoes, may not be observed until the caterpillars have attained large size, when the injury is irreparable. In fields of young cane where toads are abundant, and nothing much else exists for them to eat, they may devour large numbers of these caterpillars, excrement pellets having been found containing dozens of the characteristic skulls of the larvae marked with an inverted "Y". Up to the time that DDT became commercially

available, arsenate of lead was the standard, but not particularly effective remedy for the control of *Laphygma*, often ineffective because applied when the caterpillars were fully-grown, or so large that they could eat some of the poison with comparative immunity. Dusting young corn or cane plants with DDT gives prompt control, so immediate and so effective that this means of control is being increasingly used by many growers. The adult of *Laphygma frugiperda* has silvery white hind wings, and grey-brown fore-wings which may be almost devoid of any pattern, or in other individuals with conspicuous markings of light and dark. In the experience of Prof. Forbes the difference in pattern is purely sexual: all the males having the showy pattern and all the females being plain, as in *Prodenia latifascia*. The caterpillars show little variation and are easily recognized by the inverted "Y" on the head and four black spots arranged in a trapezoid on most segments dorsally, most conspicuous on the smaller green caterpillars but still apparent on the plump, purplish-grey fully-grown larvae.



Just-hatched caterpillar, greatly enlarged, and fully-grown caterpillar, twice natural size, of *Laphygma frugiperda* (Smith & Abbot). (Drawn by W. R. Walton, U. S. D. A.)

Xylomiges eridania (Cramer) was listed from Puerto Rico as a *Callierges* by the early entomologists, Herr Möschler (1880–138) noting "Raupe auf *Amaranthus, Solanum torvum, Phytolacca decandra.*" In addition to such weed hosts, the cutworms may also attack tomatoes, potatoes, peppers and tobacco, and are recorded from Swiss chard and mulberry, occurring in all parts of the Island. The light grey adults are common at light; repeatedly intercepted at Bayamón, Mr. E. G. Smyth having collected sixty at Hda. Santa Rita, Guánica during the summer and autumn of 1913.

Xylomiges recondita, described from Puerto Rico as a *Callierges* by Herr Heinrich B. Möschler (1890–140), has not since been found.

Xylomiges sunia Guenée was listed from Puerto Rico by Herr Möschler, Dr. Gundlach noting "la oruga se cría en *Gossypium.*" It is P.R. 1443 on Van Zwaluwenburg's list, and Dr. Richard T. Cotton (1918–287) notes it as "extremely destructive to a great many vegetable crops, being particularly abundant on chard. The small, green, dome-shaped eggs are laid in clusters of two or three hundred on the leaves, and are covered with a light white fuzz. They hatch in about four days into caterpillars that

when full grown are about an inch and a quarter long. They are dark grey in color, striped on the sides with a broad yellow band, and marked on the back with several velvety black patches." Mr. Ignacio Torres, in discussing "El Cultivo de Papas en Puerto Rico" (Rev. Agr. P. R., **24** (6): 239–242. San Juan, 1929), notes their attack on Irish potatoes. They have also been found eating celery, asparagus, green peas, alfalfa and tobacco. The adults are practically indistinguishable from *X. eridania*, their most apparent difference being a black spot or pair of black spots near the middle of the forewing towards the costal margin.

Galgula partita Guenée is listed from Puerto Rico by Herr Möschler and Dr. Gundlach.

Micrathetis triplex (Walker) is identified from San Juan, Coamo and Ensenada by Dr. Schaus (1940–199). Prof. J. A. Ramos (1947–45) collected it, as determined by Prof. Forbes, at light on Mona Island.

Hadena ? ligata was described from Puerto Rican material by Herr Heinrich B. Möschler (1880–130), and was at one time thought by Dr. Schaus to be a *Monodes*, but no specimen has been collected since the type by Dr. Gundlach.

Elaphria agrotina (Guenée) has been repeatedly intercepted at light in the metropolitan area of San Juan, and at Bayamón; Dr. Schaus (1940–200) lists collections at Aibonito, Coamo, Lares and Guánica, and Mr. J. F. Gates Clarke thus identified specimens taken by Dr. W. A. Hoffman at El Semil. The three specimens of what Mr. E. G. Smyth called a "rare brown-and-buff Noctuid" which he collected during the summer of 1913, were first determined by Dr. Schaus as the *Monodes* which Herr Möschler described (1890–127) from Puerto Rican material as *Hadena arna*.

Elaphria andersoni is described by Dr. Wm. Schaus (1940–201) from material intercepted at light at Bayamón by Mr. C. G. Anderson as having a wingspread of 13 mm., its "forewing mostly aeneous sayal brown."

Elaphria arnoides (Herrich-Schäffer) is listed by Dr. Schaus (1940–200): "a specimen from an old Porto Rico collection, with written label identification."

Elaphria deltoides, described as a *Erastria* by Herr Heinrich B. Möschler (1880–399), was identified by Dr. Wm. Schaus as a specimen intercepted at light at Bayamón, but later (1940–200) he states "no specimens have been received from Porto Rico."

Elaphria nucicolora (Guenée), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Monodes*, has been intercepted at light in the San Juan metropolitan area, and Mr. Frank E. Watson thus identified the dozen "Brownsville Noctuids" which Mr. E. G. Smyth collected at light during the summer of 1913 at Hda. Santa Rita, Guánica. Prof. Forbes lists additional collections at Cataño, Toa Baja, Lares, Coamo and Aguirre.

Elaphria phalega is described by Dr. Wm. Schaus (1940–201), the type from Coamo, as having a "forewing aeneous olive brown, the markings very faint," allied to "*E. nucicolora* Guenée, form *clara* Harv."

Elaphria promiscua was described as a *Caradrina* by Herr Henirich B. Möschler (1880–144) from material collected by Dr. Gundlach in Puerto Rico.

Elaphria subobliqua (Walker), listed from Puerto Rico as *Hadena chalcedonia* Hübner by Herr Möschler and Dr. Gundlach, was collected at light at Utuado by Dr. W. A. Hoffman, and Dr. Schaus (1940–201) lists it from San Juan.

Bryolymnia huastea was described by Dr. Wm. Schaus (1940–203) from a single female from Bayamón, mostly white in color, the "forewing white with black markings."

Bagisara repanda (Fabricius), listed as *Atethmia inusta* Guenée by the early entomologists, was identified for Mr. E. G. Smyth, who collected twenty-five specimens at light at Hda. Santa Rita, Guánica during the summer of 1913, as *Bagisara inusta* Guenée by Mr. Frank E. Watson. "So often was this moth seen at night on the foliage of "salcilla" (*Morongia leptoclada* = *Leptoglottis portoricensis*), that it is believed the larva must feed on that tree." The adults, identified by Dr. Schaus as *Bagisara subusta* Hübner, have three wavy lines across their light yellowish-brown forewings, the outer margin being considerably darker. Dr. Schaus lists (1940–204) additional collections at San Germán, Adjuntas and Coamo, and Prof. Forbes found it on Vieques Island as well as on El Yunque and at Lares and Isabela.

Bagisara buxea (Grote) is listed by Dr. Schaus (1940–204) from Coamo and Guayama.

Sesamia vuteria (Stoll) is listed from Puerto Rico by Dr. Schaus (1940–205): "bred from green chick pea."

Caularis undulans Walker, listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Eudryas bartholomaei* Boisduval, a large white and yellow Noctuid, was collected at light at Hda. Santa Rita, Guánica by Mr. E. G. Smyth three times during the summer of 1913. Dr. Schaus (1940–205) lists additional collections from Guayama. The anal angle of the yellowish hind wing has a conspicuous brownish lunule; the pinkish-white forewing is broadly margined with light brown, its inner edge dark brown.

Cydosia nobilitella (Cramer), listed under this name by all the early entomologists from Puerto Rico, is P. R. 1439 in Van Zwaluwenburg's list. It is a very striking moth, the forewings having six, or nine or more large white spots surrounded with purplish-brown, the ground color purplish-red; the hindwings white margined with black in the males, entirely black for the females. Mr. E. G. Smyth collected fifteen of this or the following species at light at Hda. Santa Rita, Guánica, in the summer of 1913, of

which he thought the larvae fed on *Solanum*. It is by no means a xerophytic Noctuid, however, as adults have been found at Mameyes and Río Piedras, and Dr. Schaus (1940–206) records additional collections at San Germán, Mayagüez, Coamo and Santurce.

Cydosia submutata (Walker) is identified by Dr. Schaus (1940–206) from Santa Rita, presumably the material collected by Mr. E. G. Smyth.

Eublemma cinnamomea (Herrich-Schäffer), listed from Puerto Rico as a *Thalpochares* by Herr Möschler and Dr. Gundlach, has been intercepted at light at Bayamón, as identified by Dr. Schaus. Prof. Forbes found it common on El Yunque, and has specimens from Cataño and San Germán.

Eublemma minima (Guenée) is identified by Dr. Schaus (1940–208) from Coamo and Cataño. Prof. Forbes collected it on Vieques Island.

Eublemma obliqualis (Fabricius), listed as a *Thalpochares* from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–207) from San Juan and San Germán. Prof. Forbes found it on Vieques Island, and the Cornell University collection contains specimens from seven Puerto Rican localities.

Eublemma sydolia is described by Dr. Wm. Schaus (1940–207) from a single male from Río Piedras with a wing expanse of 13 mm., the "forewing whitish irrorated with shell pink," collected by Mr. Tho. H. Jones, August 9, 1914. Other specimens were collected by Dr. M. D. Leonard at Cataño and Aguirre.

Cobubatha albipectus described by Herr Heinrich B. Möschler (1890–167) as a *Thalpochares* from material collected in Puerto Rico by Dr. Gundlach, is recognized by Dr. Schaus (1940–209) from Vieques Island: fresh material collected by Prof. Wm. T. M. Forbes.

Cobubatha coamona is described by Dr. Wm. Schaus (1940–208) from numerous specimens from Coamo and Aguirre showing considerable variation, with a wing expanse of 10 mm., "forewing with basal half rosy olivaceous, only base itself fuscous."

Cobubatha luxuriosa (Smith) is recognized by Dr. Schaus (1940–209) from Coamo.

Cobubatha putnami, described as a *Thalpochares* by Herr Heinrich B. Möschler (1890–168) from material collected by Dr. Gundlach in Puerto Rico, has not since been found locally.

Cobubatha quadrifera (Zeller), re-described from Puerto Rico as *Thalpochares grapholithoides* by Herr Möschler (1890–167), and thus listed by Dr. Gundlach, is identified by Dr. Schaus (1940–209) from Ensenada, San Germán, Aibonito and Coamo; Dr. W. A. Hoffman collected it at El Semil, as identified by Mr. J. F. Gates Clarke, and Prof. Forbes found it on Vieques Island and has specimens from five Puerto Rican localities.

Erastria minima Herrich-Schäffer is listed from Puerto Rico by Herr Möschler (1890–152) and Dr. Gundlach.

Ozarba cinda is described by Dr. Wm. Schaus (1940–210) from a single male from Coamo with wing expanse of 6 mm., a complicated wing pattern in sienna and buff.

Ommatochila mundula (Zeller), listed from Puerto Rico as a *Thalpochares* by Herr Möschler and Dr. Gundlach, has been intercepted at Mayagüez, and Dr. Schaus (1940–210) lists collections at San Germán and Coamo. It is a little brown moth the darker basal two thirds of the forewing sharply cut off from the lighter marginal area.

Amyna bullula (Grote), re-described by Herr Heinrich B. Möschler (1890–163) under the name of *Mesostrota imprimata* from material collected in Puerto Rico by Dr. Gundlach, has not since been found locally.

Amyna octo (Guenée), listed from Puerto Rico as *Mesostrota stigmatula* Snell by Herr Möschler and Dr. Gundlach, was collected at light at Hda. Santa Rita, Guánica by Mr. E. G. Smyth. He found seven individuals of this small chocolate-brown Noctuid, as identified by Dr. Schaus, of which some were presented to Mr. Frank E. Watson, but Dr. Schaus (1940–211) reports "no specimens from Porto Rico." Of the specimen which he identified, now in Río Piedras collection, the hindwings are almost if not quite as dark brown as the forewings, which bear a faint pattern and are very narrowly margined with darker brown.

Anateinoma affabilis was described by Herr Heinrich B. Möschler (1890–170) from Puerto Rican material collected by Dr. Gundlach, but no individuals have since been found.

Lithacodia apicosa (Haworth) was listed from Puerto Rico by Dr. Stahl as *Erastria nigritula* Guenée, and by Herr Möschler and Dr. Gundlach as an *Erastria*. It has not since been found locally.

Chobata discalis Walker is identified by Dr. Schaus (1940–213) from Vieques Island, and from Coamo in Puerto Rico.

Xanthoptera aurifera Walker, re-described by Herr Heinrich B. Möschler (1890–158) as *X. tripuncta* from Puerto Rican material collected by Dr. Gundlach, is identified by Dr. Schaus (1940–214) from Lares, Mayagüez, Aibonito, Manatí and Coamo. Mr. E. G. Smyth took thirty of these moths at light at Hda. Santa Rita, Guánica during the summer of 1913. They have golden yellow forewings, darker on the margins, and silvery white hindwings, gradually darkening at the outer edges.

Xanthoptera botyoides Guenée, listed from Puerto Rico by Drs. Stahl and Gundlach and Herr Möschler, has been repeatedly intercepted at Río Piedras and at Dorado.

Xanthoptera nigrofimbria Guenée was the identification by Dr. Wm. Schaus of moths intercepted at light at Bayamón.

Xanthoptera operta, as a *Krugia*, was described by Herr Heinrich B. Möschler (1890–164) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus lists a subsequent collection (1940–214) at San Juan.

Xanthoptera portoricensis was described by Herr Heinrich B. Möschler (1890–158) from material collected by Dr. Gundlach, and Dr. Schaus (1940–214) identifies as this species moths collected at Aguirre.

Heliocontia margana (Fabricius), re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–156) under the name of *Emmelia variegata*, and the variety *ochracea*, has been intercepted at Bayamón and at Mayagüez. Dr. Schaus (1940–215) notes additional collections at Ponce, Tallaboa, Ensenada, San Germán, Coamo and Aibonito. It is a little brownish moth with large, irregular whitish areas along the costal margin of the forewings. Prof. Forbes found it on Vieques Island.

Heliocontia pantherula (Herrich-Schäffer), listed by the earlier entomologists as *Emmelia uncinula* H. S., is identified by Dr. Schaus (1940–214): a little grey moth with irregular lighter areas on the forewings.

Heliocontia perstructana (Walker), listed by the earlier entomologists as *Emmelia felina* H. S. and *E. trigidula* H. S., has been intercepted at Bayamón, as identified by Dr. Schaus, and listed by him (1940–215) from Coamo.

Spragueia dama (Guenée), listed by Herr Möschler and Dr. Gundlach as an *Emmelia*, has been intercepted at light at Bayamón. Mr. E. G. Smyth collected thirty-four adults at light at Hda. Santa Rita, Guánica during the summer of 1913. Dr. Schaus determined as this species a little moth found resting on cane at Rincón, December 11, 1919, and he lists (1940–216) additional collections at Coamo and Aibonito. A large median area of light yellow, and smaller ones towards base and apex, are on the costal margin of the reddish-brown forewings of this little moth.

Graeperia costalis (Walker) has the head, collar, shoulder lappets and costal margin of forewings creamy yellow; the remainder of forewings and body golden brown. Dr. Schaus (1940–216) has identified specimens from Ensenada, Coamo and El Yunque, and Prof. Forbes has them from Aguirre and Vieques Island.

Graeperia indubitans (Walker) is listed by Dr. Schaus (1940–216) from Coamo and Ensenada.

Tarachidia flavibasis Hampson "is common in Porto Rico" according to Dr. Schaus, who lists collections from Arecibo, Aibonito, Coamo, San Germán and Ensenada. Mr. Francisco Seín found it at Lares. Prof. Forbes notes that only the male has the yellow base; the female is entirely shades of dull brown.

Tarachidia mixta, described by Herr Heinrich B. Möschler (1890–154)

as an *Acontia* from Puerto Rican material collected by Dr. Gundlach, and thus listed by him, is identified by Dr. Schaus (1940–217) from Ensenada and Coamo.

Haplostola aphelioides was described by Herr Heinrich B. Möschler (1890–163) from specimens collected in Puerto Rico by Dr. Gundlach, and was thus listed by him. It has not since been found.

Eutelia ablatrix (Guenée), listed as a *Penicillaria* from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–218) from San Germán and Coamo.

Eutelia blandula (Herrich-Schäffer), listed as a *Eurhipia* from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–218) from Coamo.

Eutelia piratica is described by Dr. Wm. Schaus (1940–218): a single male from San Germán with a wing expanse of 15 mm., mostly pinkish cinnamon, pinkish buff, vinaceous buff or vinaceous fawn, with complicated pattern in white. An adult, as identified by Prof. Wm. T. M. Forbes, was taken at light on Mona Island by Prof. J. A. Ramos (1940–45).

Eutelia pyrastis Hampson is identified by Dr. Schaus (1940–218) from Coamo and Aguirre.

Paectes arcigera (Guenée), listed from Puerto Rico by the early entomologists as an *Ingura*, has been intercepted at light at Bayamón and at San Juan.

Paectes devincta (Walker), re-described from Puerto Rico by Herr Heinrich B. Möschler under the name *Ingura vittata*, and thus noted by Dr. Gundlach to be "solamente conocida de Puerto Rico," has been intercepted at light at Bayamón.

Paectes lunodes (Guenée) is identified by Dr. Schaus (1940–220) from Coamo and Ensenada.

Paectes obrotunda (Guenée) was re-described from Puerto Rico by Herr Heinrich B. Möschler (1890–170) under the name *Ingura elegans*, and it is thus listed by Dr. Gundlach. The dozen specimens which Mr. E. G. Smyth collected at light at Hda. Santa Rita, Guánica during the summer of 1913, identified by Dr. Schaus, have a wingspread of 22 mm.; the veins of the hindwings outlined in brown; the dark grey forewings, with two major, darker, curved stripes and other less well defined markings, but hardly anything to merit the name *elegans*. Dr. Schaus (1940–221) notes collections in Vieques Island and on St. Thomas, as well as at Coamo and San Germán.

Stictoptera vitrea Guenée, listed by the early entomologists from Puerto Rico under this name, has been intercepted at light at Bayamón, as identified by Dr. Wm. Schaus.

Characoma nilotica (Rogenhofer), re-described by Herr Heinrich B.

Möschler from Puerto Rico (1890–212) under the name of *Paraxia chamaeleon* and thus listed by Dr. Gundlach, has been reared from semi-transparent, greenish-white larvae feeding on the buds and webbing together the small leaves of "sauce" or Humboldt's willow (*Salix chilensis*) at Aguadilla in January 1922. Mr. E. G. Smyth collected thirty of these small grey Noctuid moths at light at Hda. Santa Rita, Guánica during the summer of 1913, and it has also been intercepted at light at Bayamón.

Prof. Forbes doubts if this is the old world *C. nilotica*, of which the larva is supposed to feed on tamarisk. The Cornell University collection contains specimens from Cataño, Jájome Alto, Guayama, Aguirre, Coamo and San Germán.

Casandria abseuzalis (Walker) was re-described by Herr Heinrich B. Möschler (1890–147) under the name of *Pleurasympieza smithii* from Puerto Rican material, and it is thus listed by Dr. Gundlach. Mr. E. G. Smyth collected a dozen of these light brown Noctuids, as determined by Dr. Harrison G. Dyar, at light at Hda. Santa Rita, Guánica during the summer and autumn of 1913. Dr. Schaus (1940–223) records additional collections at Palmas Abajo (between Guayama and Jájome Alto) by Dr. W. A. Hoffman, and at Coamo and Manatí. On light grey forewings are zig-zag narrow bands of dark brown; the semi-transparent silvery hindwings are narrowly margined with brown. Prof. Forbes found it on Vieques Island, and has specimens from Dorado and Santurce.

Casandria ferrocana (Walker) was re-described as *Leianophora transfossa* by Herr Heinrich B. Möschler (1890–136, fig. 16) from Puerto Rican material, and under that name it is listed by Dr. Gundlach. Dr. Schaus (1940-222) notes recent collections at Guánica.

Casandria filifera (Walker) was re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–145, fig. 17) under the name of *Collomena elota*, and under that name it is listed by Dr. Gundlach. Dr. Schaus (1940–223) records a recent collection from El Yunque.

Iscadia aperta Walker was re-described as *Eucalypta schildei* from Puerto Rican material by Herr Heinrich B. Möschler (1890–148, fig. 23), and thus listed by Dr. Gundlach. Dr. Schaus (1940–224) lists collections from Coamo and Río Piedras.

Achaea ablunaris (Guenée), of which Herr Möschler (1890–202) as an *Ophisma* described the local Puerto Rican variety under the name of *hilaris*, was listed by Drs. Stahl and Gundlach. No recent collection has been made locally.

Ophisma tropicalis Guenée, listed from Puerto Rico by all the early entomologists, of which Dr. Gundlach notes "oruga en *Cupania*," has not been collected subsequently.

Mocis antillesia Hampson, listed in "Insectae Borinquenses" (1923–168) as *Mocis marcida* Guenée, as determined by Dr. Wm. Schaus, was first collected in Puerto Rico by Mr. D. L. Van Dine in December 1911, at light at Río Piedras. Several collections have since been made at light at the same locality. The larva when fully-grown is a large grey caterpillar with concealed black and white spots at the dorsal sutures, exposed on looping of the body, which feeds on the leaves of cowpeas. The adult is a large purplish-brown moth, both fore and hind wings banded; the forewings with a black spot nearly 1 mm. in diameter on inner margin near base; the males with heavily plumed hind legs.

Mocis disseverans (Walker), as identified by Dr. Wm. Schaus, has been repeatedly intercepted at light at Bayamón and in the metropolitan area of San Juan, and additional collections are noted by him (1940–226) at Coamo and Aibonito.

Mocis megas (Guenée), listed as a *Remigia* by all the earlier entomologists, has been collected at light at Bayamón, Río Piedras, Mameyes and Guánica; quite similar in general appearance to *antillesia*, but with the black spot near the base of the forewing very small or absent. The caterpillar has been found feeding on the leaves of velvet beans at Río Piedras. Dr. Schaus (1940–226) lists collections of adults at Fajardo, Arecibo, Coamo and San Germán. Prof. J. A. Ramos (1947–45) found them common at light, Sardinera Beach, Mona Island.

Mocis munda (Walker), as identified by Prof. Wm. T. M. Forbes, was collected by Mr. Harry Beatty on Mona Island, August 1944. Prof. Forbes notes that this is the smallest and most yellow species of *Mocis*, and suspects that it is "the true *repanda* of Fabricius," but is not sufficiently sure to use the name. He has additional specimens from Cuba, Haiti, St. Croix and Martinique, but not from Puerto Rico.

Mocis repanda (Fabricius), originally described as a *Noctua*, was listed from Puerto Rico by Dr. Stahl as *Remigia latipes* Guenée, and under this name and as *Remigia repanda* Fabricius, not in synonymy, by Herr Möschler and Dr. Gundlach. Indeed, the latter name was used by all the economic entomologists: thus listed by Mr. R. H. Van Zwaluwenburg, number 1507: on millet and grasses, and by Mr. D. L. Van Dine (1913–257 and 1913–31), Mr. Thos. H. Jones (1913–230 to 236, 1914–463) and Mr. E. G. Smyth (1919–144), who note the larva as a pest of sugar-cane, feeding on the leaves. The most complete account (Jones and Wolcott 1922–49) describes all stages and lists the parasites reared: *Phorocera claripalpis* Macq., *Linnaemyia fulvicauda* Walton, *Helicobia helicis* TT. from the larvae, and *Sarcophaga sternodontis* TT from the pupa, and in addition to these flies, the wasps *Chalcis robustella* Wolcott and a species of *Rogas*.

Larvae have also been noted at Morovis (Wolcott 1921–38) parasitized by a species of *Euplectrus*. The caterpillars are eaten by the lizards *Anolis pulchellus*, *A. krugii*, *A. stratulus* and *A. cristatellus*, when abundant in cane fields, and presumably would also be eaten by the introduced toad, but Dr. Wetmore reports neither larva nor adult consumed by any bird. Periods of unusual abundance of the striped looper caterpillars on fields of young cane are normally followed by several years when none are to be found, which is hardly surprising considering the number of parasites and other natural enemies which converge on an outbreak. The caterpillars are partial to the leaves of young cane, but often attack weed grasses in the cane fields, as well as meadows of malojillo or guinea grass, and young stands of elephant grass. "They follow the same pattern of seasonal abundance: our (Wolcott and Martorell 1943–92) records of injury being for October, November and December; pupae and old injury in January; one record of small caterpillars in February at Manatí and another in July at La Vega, Arecibo" for the years 1936–1941. The moths are smaller than others of the genus, lavender or purplish brown, the outer third of the wings darker, and are often attracted to light during winter months in the coastal cane areas.

As *Mocis latipes* Guenée identified by Prof. Wm. T. M. Forbes, it was recorded by Prof. J. A. Ramos (1940–45), collected at light on Mona Island.

Phurys immunis Guenée, listed from Puerto Rico by the early entomologists, is recorded by Dr. Schaus (1940–227) from Aibonito and Coamo, and from Vieques Island. It is a light grey moth, the outer third of its wings darker, with basal third of the forewings cut off by a narrow dark band.

Nymbis helvina (Guenée) is listed from Puerto Rico by Drs. Stahl and Gundlach under the name *Phurys helveola* H. S.

Nymbis garnoti (Guenée) as a *Phurys* is listed by the earlier entomologists from Puerto Rico.

Safia acharia (Cramer) is listed as *Yrias* from Puerto Rico by Dr. Gundlach, but Dr. Schaus (1940–228) is of the opinion that Herr Möschler's record is a mis-identification.

Zale erilda is described by Dr. Wm. Schaus (1940–230) from a single male intercepted at Bayamón with a wing expanse of 48 mm., the forewings mostly "light ochraceous buff" with black markings. As *Homoptera lunata* Drury he presumes this species was reported from Puerto Rico by Herr Möschler and Dr. Gundlach.

Zale exhausta (Guenée) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach as an *Homoptera*.

Zale fictilis (Guenée), listed from Puerto Rico as an *Homoptera* by Herr Möschler and Dr. Gundlach, was identified for Mr. E. G. Smyth as

Homoptera terrosa Guenée by Dr. Schaus: adults at light at Río Piedras. These are large grey moths with numerous wavy dark brown bands, a double one on the hindwings being most conspicuous.

Zale setipes (Guenée) is listed as a *Xylis* from Puerto Rico by the early entomologists, and Dr. Schaus (1940–229) records a more recent collection at Coamo.

Autoplusia egena (Guenée) was identified by Dr. Wm. Schaus from a shining golden-brown adult reared from a green looper caterpillar collected on shade tobacco at Cayey in January 1923. A year later other adults were reared from looper caterpillars on tobacco at Corozal. It was noted that the caterpillars were most abundant on the tobacco growing on the hills sloping to the north; those sloping to the south and west showed little injury by any kind of caterpillar.

Autoplusia illustrata (Guenée) was intercepted at light at San Juan and determined as a *Phytometra* by Dr. Schaus.

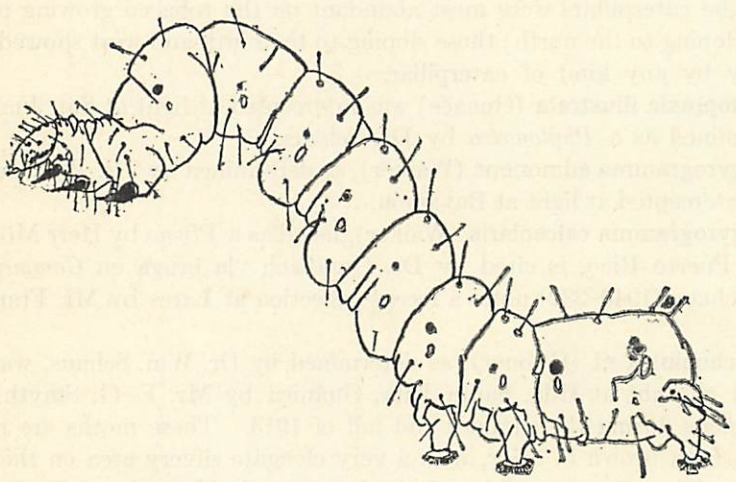
Argyrogramma admonens (Walker), as determined by Dr. Wm. Schaus, was intercepted at light at Bayamón.

Argyrogramma calceolaris (Walker), listed as a *Plusia* by Herr Möschler from Puerto Rico, is cited by Dr. Gundlach "la oruga en *Commelina*." Dr. Schaus (1940–232) notes a recent collection at Lares by Mr. Francisco Seín.

Trichoplusia ni (Hübner), as determined by Dr. Wm. Schaus, was collected at light at Hda. Santa Rita, Guánica by Mr. E. G. Smyth: five specimens during the summer and fall of 1913. These moths are rather small, light brown in color, with a very elongate silvery area on the forewings. They are the adults of the injurious "cabbage looper" of continental United States.

Pseudoplusia oo (Cramer) was listed from Puerto Rico by Dr. Stahl as *Plusia binotula* H. S., and by him and the other earlier entomologists as *Plusia rogationis* Guenée. Dr. Richard T. Cotton (1918–311) studied it as a pest on tomato, but it is possibly more seriously injurious on tobacco, being called by the growers "el agrimensor verde." Injury does not cease when the leaves are cut, for the large caterpillars continue their development eating the wilted and curing leaves in the drying shed. They may feed on other vegetables as well, having been reared to adult eating nothing but beans, cabbage, sweet potatoes or lettuce. The adults are a rich dark golden-brown, with two conspicuous silvery spots on the forewings; the smaller one almost circular, the larger one oval, less well defined at side, and outlining a question mark. They have been taken at light at Guánica as well as generally in the mountains and along the north coast, and on Mona Island by Prof. J. A. Ramos (1947–45).

Phytometra verruca (Fabricius), originally described as a *Noctua*, and by Herr Möschler and Dr. Gundlach listed from Puerto Rico as a *Plusia*, was reared by Mr. Thos. H. Jones from larvae on purslane, and subsequently by Mr. E. G. Smyth at Río Piedras on "blero" (*Hyptis capitata*). Adults have repeatedly been intercepted at light at Bayamón and San Juan, and Dr. Schaus (1940–232) records collections at San Germán and from Vieques Island. They are rather small, richly golden brown moths, the two oval silvery spots of the forewings being of very unequal size.



Larva of *Pseudoplusia oo* (Cramer), five times natural size. (Drawn by G. N. Wolcott.)

Toxonprucha diffundens (Walker), re-described from Puerto Rico as *T. amoena* by Herr Heinrich B. Möschler (1890–198), and thus listed by Dr. Gundlach, is identified by Dr. Wm. Schaus (1940–233) from Coamo, Guánica and San Germán.

Pseudyrias watsoni is described by Dr. Wm. Schaus (1940–234) from a single female from Ensenada collected by Mr. Frank E. Watson, with a wing expanse of 29 mm. mostly black, brown or similarly dull colored.

Meridyrias progenies (Guenée), listed as a *Yrias* from Puerto Rico by the early entomologists, and also in Van Zwaluwenburg's list (P. R. 1408), was collected at light at Hda. Santa Rita, Guánica by Mr. E. G. Smyth. He found these sooty little Noctuid moths, with numerous

wavy lines on both fore and hind wings, most abundant during July and August. Dr. Schaus (1940–235) notes additional collections at Coamo and Ponce.

Lyncestis acontioides (Guenée) was listed as *Stictoptera penicillum* H. S. from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga vive en *Parkinsonia aculeata* y en *Poeppigia procera*." Dr. Schaus (1940–236) identifies moths from Mameyes, Coamo and Guánica. Those from Guánica were identified by Mr. Frank E. Watson for Mr. E. G. Smyth as *Melipotis acontioides* Guenée (= *M. sinualis* Harvey), and under this name his collections at light were listed in "Insectae Borinquenses" (1936–436), eighteen having been taken from October to December 1913. Had Smyth happened to collect after an outbreak of these caterpillars on "flamboyán" (*Poinciana regia*), such as occurred in 1937 and 1941 at Guánica, he would have found them overwhelmingly numerous. An outbreak on the flamboyán trees in Hato Rey and the Condado became so serious that it was reported in an article in "El Mundo," August 10, 1933. The landlord of a house surrounded by infested flamboyán trees lamented that one tenant had just moved out because of the annoyance of the hungry caterpillars, and others who came to look at the house would not even enter the gate. Another outbreak at Manatí defoliated trees along the road to Ciales for a long distance. Such defoliations are not serious from the point of view of the trees themselves, for flamboyán leaves grow out with surprising rapidity and a few weeks later there is no trace of injury. The caterpillars have also been reared from "palo verde" (*Parkinsonia aculeata*) at Faro de Cabo Rojo, confirming Dr. Gundlach's observation. Indeed, considering that the flamboyán was already a common tree in Puerto Rico at the time he was here, it is surprising that he failed to note it as host for these caterpillars. *Poeppigia procera* is a name not found in any modern botany, and possibly it does indeed refer to the flamboyán. The caterpillars are slender, striped with dark greenish-brown, and prefer to rest during the daytime under loose bark, crowding by the dozens into any suitable hiding-place, and later filling it with their cocoons. The adults have silvery white hindwings, deeply margined with dark brown or black, the forewings obscurely patterned in grey.

Melipotis contorta (Guenée), listed as a *Bolina*, or as *Bolina striolaris* H. S. by Dr. Gundlach and Herr Möschler, has since been found on Mona Island by Prof. J. A. Ramos (1947–45).

Melipotis famelica (Guenée), listed from Puerto Rico by the early entomologists as *Bolina leucomelana* H. S., is identified by Dr. Schaus (1940–237) from Coamo, Ponce and Guánica. More than half of the hind wings of these moths are black, but the black "does not reach the anal angle."

The forewings are mostly dark brown, with lighter area and transverse band narrowly outlined with a most convoluted black margin. Mr. E. G. Smyth took eighteen of these moths at light during October and November of 1913 at Hda. Santa Rita, Guánica, and Mr. Norberto Lugo collected many at light at Guánica Insular Forest in August 1941. Mr. Francisco Seín collected caterpillars on "salcilla" or "zarcilla" (*Leucaena glauca*) at Yauco in November 1923, which he reared to adult, but of which one larva was parasitized by a Tachinid fly recently identified by Mr. C. W. Sabrosky as *Euphorocera tachinomoides* TT. The species is not confined to the south coast, as one adult was collected at Isabela in December 1918, and the Cornell University collection has specimens from Dorado. Prof. Forbes noted them on Vieques Island, and Prof. J. A. Ramos found them on Mona Island in considerable abundance (1947–45).

Melipotis fasciolaris (Hübner), listed as a *Bolina* from Puerto Rico by Herr Möschler and Dr. Gundlach, is recognized by Dr. Schaus (1940–239) only from Aibonito. For Mr. E. G. Smyth he had previously identified as this species moths collected at light, Hda. Santa Rita, Guánica, with the most sharply defined pattern on their wings: the base of the forewings dark brown, with a straight-edged transverse light yellowish band, which may be what he subsequently described (1940–238) as *Melipotis guanicana*. Other adults, identified by Mr. Hahn W. Capps as *Melipotis fasciolaris*, have the base of the forewings dull greenish-brown, with no broad yellowish transverse band separating the basal area from the darker apical two-thirds. Many of these were collected at light in Guánica Insular Forest in August 1941 by Mr. Norberto Lugo, and others have been reared from dull, striped, blue-grey caterpillars found crowding under the bark scales of "guayacán" (*Guaiacum officinale*) at the same locality, May 1942, and farther west at the salt pools, March 1946. Prof. J. A. Ramos (1947–46) found one at light on Mona Island.

Melipotis guanicana was described by Dr. Wm. Schaus (1940–238) from a single female from Guánica, date of collection and collector not mentioned, with a wing expanse of 42 mm., the base of its fore wing "deep olive buff: a broad white medial fascia faintly outbent edged by fine black lines."

Melipotis indomita Walker is listed from Puerto Rico by Herr Möschler and by Dr. Gundlach, as *Bolina nigrescens* Grote and Robinson, var. *ochreipennis* Harvey. Prof. Forbes identifies as this species specimens labeled "Desengaño" collected by Dr. Stuart T. Danforth. Desengaño is the flag stop on the American Railroad and the Hacienda at Cartagena Lagoon, where Dr. Danforth made his most intensive observations on birds.

Melipotis januaris (Guenée) was listed as a *Bolina* by Herr Möschler,

Dr. Gundlach noting "esta especie varía mucho, v. gr. var. *limitata*, var. *bimaculata*, var. *confusa*, Möschler." Mr. R. H. Van Zwaluwenburg (1918–34) records thousands of larvae on "guamá" (*Inga laurina*) at Mayagüez in June 1917, which pupated in the ground. Adults have been intercepted at light in the metropolitan area of San Juan and at Bayamón, and Dr. Schaus (1940–237) notes additional collections at Ensenada, Aibonito and Coamo, and on Vieques Island, while Prof. J. A. Ramos found them at light, Sardinera Peach, Mona Island (1947–45).

Melipotis ochrodes (Guenée), which Dr. Schaus considers Herr Möschler listed from Puerto Rico as the varieties *bimaculata* and *confusa* of the preceding species, was identified by Dr. Harrison G. Dyar as *Melipotis manipularis* Guenée for Mr. E. G. Smyth, who collected nearly sixty specimens at light at Hda. Santa Rita, Guánica, during the summer and autumn of 1913. This is the name in Van Zwaluwenburg's list: P. R. 1435. The next year Mr. Smyth repeatedly collected larvae under the bark of the trees called locally "algarrobo de Hawaii," "bayahonda," or "mesquite" (*Prosopis juliflora*), or under trash at the base of these trees, which he reared to adult. They were found under the bark of these trees at Central Mercedita, Ponce, in 1922, and extensive collections of adults were made at light in the Guánica Insular Forest in August 1941 by Mr. Norberto Lugo. The transverse, lighter-colored band on the forewings occupies half of the basal area; the lighter area towards the apex is often irregularly margined with black.

Melipotis perpendicularis (Guenée) is listed by Dr. Schaus (1940–239) from Puerto Rico, "without precise locality."

Pararcte schneideriana (Cramer), originally described as a *Noctua*, Dr. Schaus identified as a *Cocytodes*: a single specimen collected at light at Río Piedras by Dr. Richard T. Cotton on May 1, 1916. It is a large, brownish, thick-bodied moth, with a wingspread of 76 mm., its patterned forewings narrow; the dark brown hindwings with lunules on the outer margin.

Mimophisma forbesi was described by Dr. Wm. Schaus (1940–240) from a single male from Coamo with a wing expanse of 35 mm., mostly drab in color; "forewing drab crossed by rather faint light cinnamon drab vertical lines and with a few scattered black scales."

Blosyris mycerina (Fabricius), originally described as a *Noctua*, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Letis atricolor* Guenée. It was later identified by Dr. Schaus as *Letis mycerina*, the name given in "Insectae Borinquenses" (1936–434), being "widely distributed in tropical America." The caterpillars have been found feeding on coffee leaves at Lares, altho possibly originally they ate those of some endemic plant or tree of the virgin tropical rain forest. The fresh adults are almost black in color, but while still alive may fade to a dull brown,

showing the wavy pattern on the wings, the largest ones having a wingspread of close to 80 mm. They begin flying soon after sundown; in November 1921, a dozen or more were noted above Ciales sporting in a road opening. Occasionally two would snap their wings together with a sound like that made by dragonflies, and fall to the ground, scuffling in copulation. They sometimes are attracted to lights, having been intercepted at Bayamón, and are quite common in coffee fincas at the higher elevations.

Otosema odorata (Linnaeus) was listed from Puerto Rico by all the early entomologists as an *Erebus*, Dr. Gundlach noting "la oruga se alimenta de varias especies de *Cassia*, de *Pithecolobium*, etc., ocultándose durante el día entre las grietas de la corteza." It was number 1418 in Van Zwaluwenburg's list, having been reared by him on *Cassia fistula*, *Pithecolobium saman* and *Ficus* sp., but without record of anything more concerning the caterpillars. The adults have possibly the largest wing area of any moth found in Puerto Rico, mostly dull brown with innumerable lighter or darker wavy lines; a small eye-spot on the forewing and a double one on the hind wing. They are sometimes found hiding in the dark corners of a house early in the morning, and by the more superstitious thought to be an omen of death. Some houses, poorly illuminated at night, with dark interior walls and densely shaded by surrounding trees, may prove especially attractive to these big, black, fluttery moths, one or more of them haunting it nearly every twilight both night and morning.

Peosina numeria (Drury) was listed from Puerto Rico by all the early entomologists, but has not since been collected locally.

Hemeroblemma rengus (Poey), listed as a *Brujas* from Puerto Rico by Herr Möschler and Dr. Gundlach, has not since been collected locally.

Latebraria amphipyroides Guenée, listed from Puerto Rico by Herr Möschler, and by Dr. Gundlach noted with the "oruga en especies de *Cassia*," has not since been collected locally.

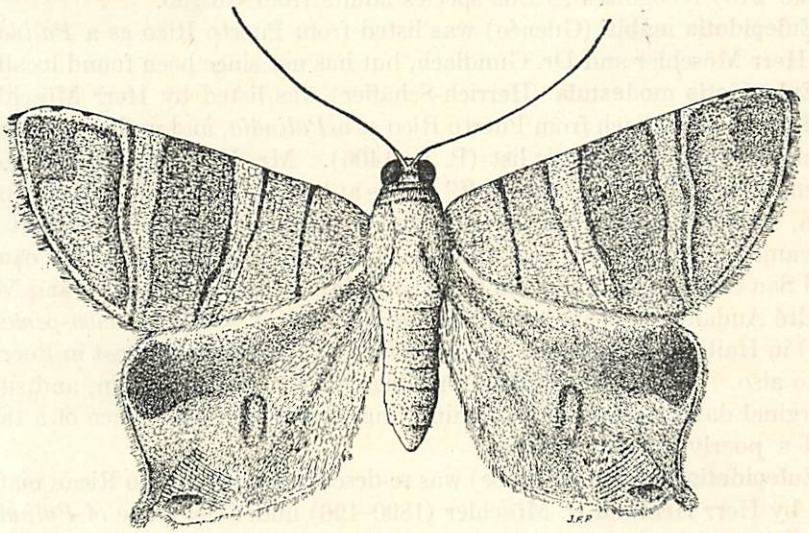
Hemicephalis characteria (Stoll), listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is recognized by Dr. Schaus (1940–244): a single specimen from Mameyes.

Pseudohemiceras krugii was described by Herr Heinrich B. Möschler (1890–176) from Puerto Rico, and listed by Dr. Gundlach. Mr. E. G. Smyth collected two adults of this brick-red Noctuid at light at Hda. Santa Rita, Guánica in the summer of 1913, and later he reared adults from larvae boring in twigs of "roble" (*Tabebuia pallida*), at Río Piedras. As observed by Drs. Donald de León and Luis F. Martorell, other species suffer similar injury: *Tabebuia rigida* at Guavate, Cayey: *T. heterophylla* at Ponce and Guánica; and Dr. Martorell noted the latter species and *T. lucida* attacked on Mona Island. The burrow opening of a caterpillar is at a crotch of a small branch, clogged with excrement and uneaten bits of

leaves, for the larva not only feeds on the pith of the twig, but at night sallies forth to drag to the entrance of its tunnel entire leaves, to be devoured in safety with its body inside the burrow.

Concana mundissima Walker, listed from Puerto Rico as his *Thelidora splendens* by Herr Möschler, and by Dr. Gundlach, is recognized by Dr. Schaus (1940–245) from Ensenada and Coamo, and from Vieques Island.

Adiopa disgrega, described by Herr Heinrich B. Möschler as a *Hadena* from Puerto Rico (1890–128), and thus listed by Dr. Gundlach, was found very abundant at light by Mr. E. G. Smyth at Hda. Santa Rita, Guánica, during the latter half of 1913, fifty-six specimens in all being taken, some



Adult of *Eulepidotis addens* (Walker), four times natural size. (Drawn by José F. Pietri.)

of these being identified by Dr. Schaus as being in the genus *Tarachidia.* These are medium-sized light grey moths with a black inverted question mark and other less pronounced black markings on the costal margin of the forewings; the silvery hindwings margined with grey.

Dyomyx juno was described by Herr Heinrich B. Möschler (1890–197) from Puerto Rico, and it is thus listed by Dr. Gundlach. It is known only from Puerto Rico, and no additional specimen has been collected since the type was found.

Eulepidotis addens (Walker), originally described as a *Palindia,* and as *Palindia variabilis,* var. *obscura* re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–195), was thus listed by Dr. Gundlach. It is a sleek little brownish moth, a darker basal cross-bar and two

double ones on the forewings; a washed-out eyespot on the tailed hindwings. Its small, green leaf-folding caterpillars have twice been found at Cayey feeding on the tender leaves of "guaba" (*Inga vera*) during the winter, and after forming slight cocoons, emerging as adults identified originally by Dr. Harrison G. Dyar and subsequently by Mr. J. F. Gates Clarke. It has been taken at light at Río Piedras, and intercepted at light at Bayamón and at Mayagüez. Dr. Schaus (1940–247) also reports collection at Lares.

Eulepidotis hebe was described as a *Palindia* by Herr Heinrich B. Möschler (1890–195) from Puerto Rican material, and it is thus listed by Dr. Gundlach. It has been intercepted at light at Bayamón, and Dr. Schaus (1940–248) recognizes as this species adults from Coamo.

Eulepidotis mabis (Guenée) was listed from Puerto Rico as a *Palindia* by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Eulepidotis modestula (Herrich-Schäffer) was listed by Herr Möschler and by Dr. Gundlach from Puerto Rico as a *Palindia*, and under this name is in Van Zwaluwenburg's list (P. R. 1406). Mr. E. G. Smyth collected twenty-six of these "medium buff" moths at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and it has been intercepted at light at Bayamón. Dr. Schaus lists additional collections (1940–248) at Coamo and San Germán, as well as in Cuba and Haiti. Dr. R. C. Smith and Mr. André Audant found its larvae defoliating trees of "ceiba" (*Ceiba pentandra*) in Haiti, and it may be presumed that this is its normal host in Puerto Rico also. The creamy yellow forewings have a darker margin, and submarginal darker cross-bars; the hindwings but the faintest trace of a tail, and a poorly-formed eye-spot.

Eulepidotis superior (Guenée) was re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–196) under the name of *Palindia dewitzii*, and is thus listed by Dr. Gundlach. It has not since been collected locally. Dr. Stahl also lists from Puerto Rico *Palindia inferior* H. S.

Noropsis hieroglyphica (Cramer) was listed from Puerto Rico by Dr. Stahl as *Euglyphia fastuosa* Guenée, and as *Noropsis fastuosa* Guenée by Dr. Gundlach and Herr Möschler, the latter noting "Raupe auf *Corchorus siliquosus*." It is P. R. 1421 in Van Zwaluwenburg's list, and he gives an extended account of it (1918–33), the caterpillars feeding on *Waltheria americana* and *Morongia leptoclada*. "The larvae are more or less gregarious, and drop to the ground when disturbed. The full grown larva is about 25 mm. long and about 4 mm. across the head. The ground color of the body is bluish or greenish white, with a black stripe running around the body on each segment. The segments are divided from one another by a narrow black line. The anal plate and head are reddish-brown, the collar shiny black. The oval pupa case, about 22 x 10 mm., is formed of parchment-like material on the stem of the food plant, and is covered with grass

and bits of leaves." The cocoons were very abundant on fence posts in cane fields at Yauco in September 1921, and two years later the caterpillars caused considerable damage to young trees of beefwood (*Casuarina equisetifolia*) at Hda. María Antonia, Guánica, boring into their tender trunks, apparently seeking a place to pupate. The adults have plain, unmarked abdomens and hindwings, but the collar and sides of thorax are light yellow, the shoulder lappets brownish with purplish iridescence; the forewings mostly yellowish with strongly contrasting hieroglyphic marks of dark brown, surrounding elongated areas of iridescent lavender. While normally most abundant in the more xerophytic areas of the Island, adults have been taken at light at Río Piedras, and Dr. Schaus (1940–248) lists additional collections at Ponce, Coamo, Mayagüez, Lares and Cataño.

Litoprosopus hatuey (Poey), originally described from Cuba as a *Noctua*, is recognized by Dr. Schaus (1940–249) from a specimen collected by Mr. Aug. Busck in Puerto Rico, and one by Dr. Wm. T. M. Forbes on Vieques Island.

Baniana relapsa (Walker), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Baniana significans* Walker, and thus identified by Dr. Schaus for Mr. E. G. Smyth: adults collected at light at Hda. Santa Rita, Guánica in 1913, is a fawn-colored moth; the forewings with a conspicuous dark brown triangle near the base, the marginal third equally dark on strongly-curved basal side, but fading towards the margin; the marginal third of the hindwings also somewhat darker. Prof. Forbes notes that "only the male has black on the wings; the female has only top of head and collar black." He has specimens from Guayama and Coamo, and from Lares collected by Mr. Francisco Seín.

Rivula pusilla was described by Herr Heinrich B. Möschler (1890–234) from Puerto Rican material collected by Dr. Gundlach. It is recognized by Dr. Schaus (1940–250): a single specimen from Lares.

Selenis suero (Cramer) was listed from Puerto Rico by the early entomologists. Dr. Schaus (1940–250) recognizes from Naguabo and Coamo this species "widely distributed in tropical America."

Selenis sueroides Guenée is listed by Dr. Stahl from Puerto Rico, and Dr. Schaus (1940–251) identifies it from Coamo, noting that it is "evidently rare in Porto Rico, but common in Cuba." Prof. Forbes has specimens from Coamo, Aguirre and Toa Baja.

Selenis portoricensis was described by Herr Heinrich B. Möschler (1890–214), the type from Puerto Rico, collected by Dr. Gundlach. It is an inconspicuous brownish moth, the costal margin of the forewings very broadly and somewhat irregularly light grey. Mr. Thos. H. Jones reared this moth, as determined by Dr. Schaus, from "yerba de ciénaga" (*Aeschynomene sensitiva*) at Río Piedras in July 1914, and adults have subsequently been

collected at Río Piedras, and in the Guánica Insular Forest at light by Mr. Norberto Lugo.

Aluaca eubolialis Walker was identified by Dr. Schaus (1940–251) from Yauco and Aguirre, and Prof. J. A. Ramos (1947–46) found a single adult as identified by Prof. Wm. T. M. Forbes at light, March 4, 1944, at Sardinera Beach, Mona Island.

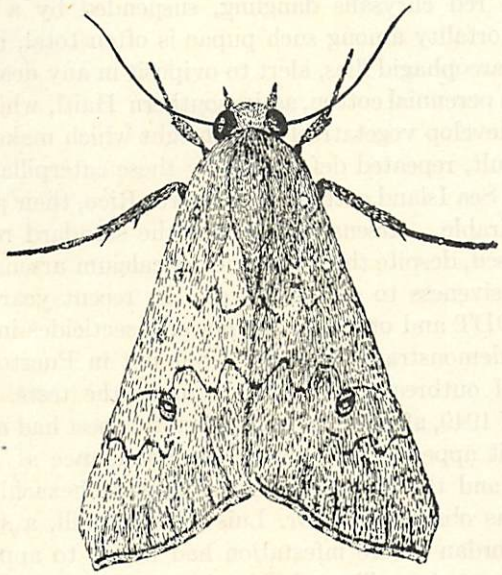
Glympis concors Hübner was re-described as *Diastema flavicapilla* by Herr Heinrich B. Möschler (1890–162) from Puerto Rican material collected by Dr. Gundlach. Mr. Thos. H. Jones found small green caterpillars stretched out along the leaflets or leaf stems of "gallito" (*Agati grandiflora*) in March 1912, which were reared to little dark-brown moths, spotted with darker brown, identified by Dr. Harrison G. Dyar as *Aluaca agilaria* Druce. Adults have also been intercepted at light at Bayamón., and in March 1949 were again found in large numbers at Río Piedras.

Trissophaes serpentinifera (Walker), as identified by Mr. J. F. Gates Clarke, is a large moth with wingspread of over 100 mm., its forewings light brown with unremarkable pattern, but bright yellow hindwings, margined with brown, with an enormous black serpent entering from the anal margin. One adult was found on the mosquito bar in the morning at Guajataca, April 23, 1940, and another at Camp Doña Juana, Villalba. This is the nearest to a *Catocala* that Puerto Rico can show.

Graphigona regina (Guenée), listed from Puerto Rico as *Ophideres gubernatrix* Guenée by Herr Möschler and Dr. Gundlach, has not since been collected locally.

Alabama argillacea (Hübner), originally described as an *Aletia*, was listed from Puerto Rico by all the early entomologists and is number 1401: on cotton, in Van Zwaluwenburg's list. It is not a permanent resident of Puerto Rico, but outbreaks have been noted since that in 1905 at Aguadilla, reported by Mr. O. W. Barrett (1906–23) and Mr. D. W. May (1906–11); at Hatillo in July 1919 reported by Mr. E. G. Smyth (1920–122); another at Hatillo in the summer of 1922 (Wolcott 1924–6), in the winter of 1922 at Cabo Rojo, reported by Mr. W. V. Tower (1924–13), continued the next year at Boquerón (Wolcott 1924–97); in all the cotton regions in 1930–31, as reported by Dr. M. D. Leonard (1931–114 and 119, 1932–130) but not on Vieques Island during these years, as noted by Mr. Arturo Riollano (1931–104); and again in the Cabo Rojo-Lajas region in the months of October and November of 1935 and 1938, extending to the north coast at Quebradillas in December, and returning again to Lajas in November 1939. In recent years, no important commercial outbreak has occurred, as is indicated by the untouched stocks of arsenate of lead held by the Co-operativa, but in 1942, a few caterpillars were noted on cotton at Río Piedras, and somewhat later at Coamo. "The Mystery of *Alabama argillacea*" (Amer.

Naturalist, 63 (684): 82–87. New York, Jan.–Feb. 1929) consists not only in its sudden appearances in such enormous numbers, and equally sudden disappearances, but in the stimuli in the tropics which can start such migrations from equatorial regions where it presumably is present at all times of year. The continued spread of outbreaks in the southern states of the United States from the Río Grande region in south Texas, and from the West Indies into south Florida, advancing thru the entire cotton region, finally ends in migratory flights of moths across the Great Lakes and the



Adult of the Cotton Caterpillar, *Alabama argillacea* Hübner, three times natural size. (Drawn by Fritz Maximilien.)

St. Lawrence into southern Canada. All of these adults perish without oviposition, and fresh infestations in the following or succeeding years originate in the West Indies or Mexico, or further south; never a return from the north. Mr. André Audant is convinced that the species is present at all times in Haiti, with caterpillars feeding on the leaves of cotton around Cap-Haitien during the winter, when the plants in the Cul-de-Sac and Presque Isle are maturing their bolls and have dropped all their yellowed leaves. Migration of the moths is not only necessary to ensure a fresh supply of food for their progeny, but during an outbreak of the larvae, so many are parasitized by the wasps *Apanteles aletiae* Riley and species of *Brachymeria*, and so many pupae are destroyed by *Sarcophaga sternodontis* TT, that a fresh generation can only escape mass attack when developing

in a location far removed from that in which the previous generation attained maturity. The moths are sleek in appearance, well fitted for making long flights, grey in color, with but the most indistinct of markings on the forewings. The eggs are laid individually, usually on the underside of cotton leaves, but several or many moths may oviposit on the same leaf. The caterpillars feed only on cotton leaves, and altho not gregarious, usually occur in such numbers as to completely defoliate all or most of the plants in large fields. Those which attain full size most rapidly spin loose cocoons in folded-over leaves, which later may be eaten by other caterpillars, leaving the purplish red chrysalis dangling, suspended by a few scattered threads. The mortality among such pupae is often total, being aided by the presence of Sarcophagid flies, alert to oviposit in any dead, dying or injured insect. On perennial cotton, as in southern Haiti, which with abundant rains may develop vegetatively to a height which makes the harvesting of bolls difficult, repeated defoliation by these caterpillars is definitely beneficial, but on Sea Island cotton, as in Puerto Rico, their prompt control is invariably desirable. Arsenate of lead is the standard remedy, and it continues to be used, despite the lower price of calcium arsenate, because of its superior adhesiveness to cotton leaves. In recent years the superior effectiveness of DDT and others of the newer insecticides in killing caterpillars has been demonstrated elsewhere, but not in Puerto Rico, due to non-occurrence of outbreaks on which to make the tests.

In the spring of 1949, after seven years when this pest had not been noted in Puerto Rico, it appeared in considerable abundance at Isabela. Not only were DDT and the gamma isomer of benzene hexachloride effective in control, but, as observed by Dr. Luis F. Martorell, a strip of cotton sprayed with chlordan before infestation had begun to appear continued to remain free from caterpillars despite heavy infestation in unsprayed fields near-by. Such repellent action of chlordan for the moths, preventing their laying eggs on sprayed cotton, has not previously been noted anywhere. All of the new insecticides are so much more promptly effective than was arsenate of lead that the growers who kept a stock on hand to be prepared for expected outbreaks can but regret their caution.

Anomis erosa Hübner is a bright golden yellow moth, the distal half of the forewings somewhat darker, the pattern outlined with narrow curving brown lines; a sharp angle on the outer margin. In January 1922, Mr. John D. More reared a caterpillar collected on cotton at Sabana Grande which Dr. Schaus identified as *Cosmophila erosa*. Under this name it had been listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga se cría en *Plumbago*, también en las *Althaea*." It was thus identified by Mr. Frank E. Watson for Mr. E. G. Smyth, who had taken forty of these moths at light at Hda. Santa Rita, Guánica during the latter half of 1913. It has been intercepted at Bayamón, and additional records

of collection at San Germán, Coamo and on El Yunque are given by Dr. Schaus (1940–253). Mr. Francisco Seín found it at Lares.

Anomis flava fimbriago (Stephens) is listed from Puerto Rico by Dr. Wm. Schaus (1940–253). Prof. Forbes notes that it looks almost exactly like *A. erosa*, but the male antennae are thicker in his specimens from Haiti.

Anomis gundlachi is the new name which Dr. Wm. Schaus (1940–254) applies to what the early entomologist in Puerto Rico listed as *Anomis fulvida* Guenée. "The *A. fulvida* of Gundlach represents accurately the male specimen from Cuba to which I apply his name. This specimen has a tuft of hairs at the base of the costa underneath, and was collected near Havana."

Anomis illita Guenée was listed from Puerto Rico by the early entomologists, and has since been taken at light in the San Juan area, at Bayamón and at Mayagüez. Dr. Schaus (1940–254) lists it from Coamo.

Anomis impasta Guenée is easily confused with *Alabama argillacea*, the caterpillars of both feeding on cotton leaves, but the larva of the *Anomis* is essentially solitary, never having been known to occur in such abundance as to constitute an outbreak. The moths are also similar, but the forewings of *Anomis* are darker, with a more distinct pattern and more golden than the dull clay of *Alabama argillacea*, and they have a distinct angle on the outer margin. Mr. E. G. Smyth, writing of the "Cotton Insects of Porto Rico" (Ent. News, **21** (5): 121–125. Lancaster, May 1920) confused the two, and recommends the destruction of "cadillo" (*Urena lobata*) and "malva de caballo" (*Malachra alceifolia* or *rotundifolia*), on which he had reared this *Anomis*, as a measure of control for *Alabama*. Dr. Harrison G. Dyar first identified this species from Puerto Rico as his *Anomis doctorum*, in error in "Insectae Borinquenses" (1936–440) as *doctorium*. No adult has been collected at light, but adults have been reared from larvae feeding on cotton at Humacao, Guayama, Villalba, Guánica, Camuy, Garrochales, Manatí and Vega Baja, and Dr. Schaus (1940–254) notes it as "widely distributed in tropical America."

Gonitis editrix Guenée is a light brownish moth, its forewings sharply angled on the outer margin and unevenly quartered by transverse lines. It was listed from Puerto Rico by all the early entomologists, Dr. Gundlach noting "la oruga se cría en *Triumfetta*." Mr. E. G. Smyth in the summer of 1916 at Río Piedras, reared several of these moths, as identified by Mr. Frank E. Watson, from "cadillo" (*Triumfetta* spp.), noting them as "a duller, darker brown than *Anomis erosa*." Dr. Schaus (1940–255) notes additional collections at Coamo and Ensenda.

Gonitis praerupta, described as an *Anomis* by Herr Heinrich B. Möschler (1890–173), is noted by Dr. Gundlach as "no está indicada de otras tierras." This is unquestionably true because the host of the larva is the endemic

"maga" (*Montezuma speciosissima*), a tree which does not occur elsewhere. The smaller caterpillars are entirely green, exactly matching the color of maga leaves, but in the last instar become tinged with pink, which becomes more intense as the larva approaches maturity. The chocolate-brown adults, with somewhat clearer hind wings, as identified by Mr. J. F. Gates Clarke, have been reared at Isabela and Toa Baja. Dr. Schaus (1940–254) writes "I have seen no material from Porto Rico, but I consider *G. hedys* Dyar the same species (type from Cuba in U. S. National Museum)," in which opinion he can hardly be correct, for the larvae of the Cuban species must feed on the leaves of a different host.

Plusiodonta thomae Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, was collected at El Semil by Dr. Wm. A. Hoffman, as identified by Mr. J. F. Gates Clarke.

Duriga nealcesalis (Walker) is recognized from Coamo by Dr. Schaus (1940–256) as being in his new genus.

Cecharismena cara was described by Herr Heinrich B. Möschler (1890–166) from specimens collected by Dr. Gundlach in Puerto Rico. Dr. Schaus (1940–256) recognizes it from Coamo, and from Palmas Abajo, a locality not to be found on most maps, but located north of Guayama to the west of the road to Cayey, where collections were made by Dr. Wm. A. Hoffman.

Cecharismena nectarea was described by Herr Heinrich B. Möschler (1890–165) from Puerto Rican material collected by Dr. Gundlach, and listed by him. As *Zagorista debora* Druce, Dr. Wm. Schaus identified these "handsome brown and grey moths" for Mr. E. G. Smyth, who had reared them from "sacatrapos" (*Caperonia palustris*) at Río Piedras during the summer of 1916. The basal third of the forewing of this little moth is sharply cut off by a broad, transverse lighter band, which is irregularly and less sharply defined apically. Prof. Forbes has specimens from Coamo and Toa Alta.

Parachabora abydas (Herrich-Schäffer), re-described by Herr Heinrich B. Möschler (1890–197) under the name of *Penicillaria cuprea* from Puerto Rican material collected by Dr. Gundlach, was thus listed by him. Dr. Wm. Schaus considered Möschler's species as being a *Eutelia*, and it is thus listed in "Insectae Portoricensis" (1923–167), and with present synonymy in "Insectae Borinquenses" (1936–429) under Möschler's specific name. Mr. E. G. Smyth collected only five of these moths at light at Hda. Santa Rita, Guánica during the latter half of 1913, but elsewhere it is quite common, Dr. Schaus (1940–257) listing collections from Lares, Isabela, San Germán and Guayama, as well as from Vieques Island. The forewings of the adult are rich purplish-brown, as are also the outer margins of the silvery hindwings.

Gonodonta clotilda (Stoll) was listed from Puerto Rico as *G. maria*

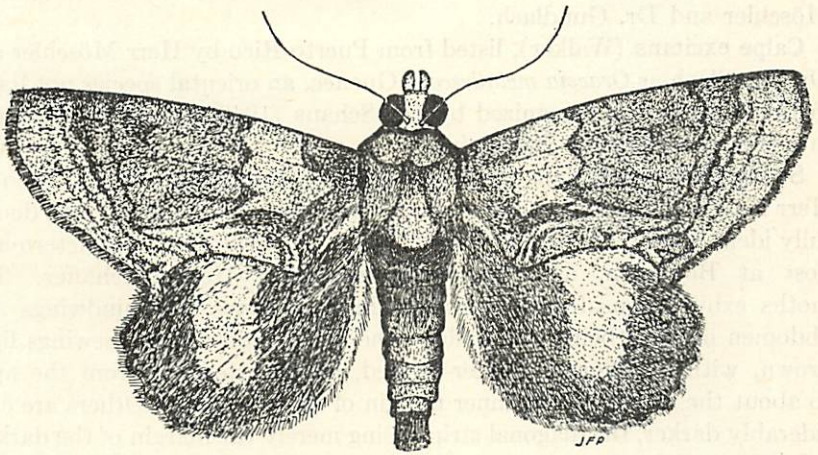
Guenée by Herr Möschler, Dr. Gundlach noting "oruga en *Anona glabra* y *palustris*, *Bocagea virgata*, *Nectandra*."

Gonodonta bidens (Hübner) was identified by Dr. Wm. Schaus as an *Athysania*: adults intercepted at light at Bayamón.

Gonodonta hesione (Drury) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach. Adults intercepted at light at Bayamón have been identified by Dr. Schaus as this species.

Gonodonta incurva (Sepp), listed by all the early entomologists as *G. teretimacula* Guenée from Puerto Rico, Dr. Gundlach noting "la oruga come *Artanthe*," is recognized by Dr. Schaus (1940–258) from Lares.

Gonodonta marmorata Schaus is recognized from Lares by Dr. Schaus (1940–258). He thinks this is presumably what Dr. Stahl listed as *Gonodonta uxoria* Cramer, and all the early entomologists listed as *Gonodonta soror* Cramer. An adult determined by Mr. Hahn W. Capps, collected by Dr. Luis F. Martorell at Villalba, May 19, 1940, has the distal half of the inner margin of the forewing cut out, and a complicated pattern of rich brown, orchid and lavender; the hindwings with a large bright yellow spot in the middle, margin very dark brown. The head, thorax and abdomen are dark brown.



Adult of the velvety black Higuillo Caterpillar, *Gonodonta nitidimacula* Guenée, a little more than twice natural size. (Drawn by José F. Pietri).

Gonodonta nitidimacula Guenée, as identified by Dr. Harrison G. Dyar, is what Herr Möschler listed from Puerto Rico as *G. latimacula* Guenée of which Dr. Gundlach noted "la oruga en *Artanthe* y *Pothomorphe*." Both of these are of the Piperaceas, and the distinctive larvae have repeatedly been noted since on them as well as on "higuillo" (*Piper amalago* or *medium*) at Río Piedras, Cayey, and generally in the lower coffee regions where

these plants are most abundant. As described in "Insectae Portoricensis" (1923–176), the caterpillar is "entirely black except for yellow clypeus, two bright yellow semi-circular spots on the sides of the first segment, two narrow reddish-orange spots on the fourth segment and two small yellow spots dorsally; two small reddish-orange spots on the sides of the seventh segment, four larger on the eighth, two large ones on the ninth and tenth and two small ones on the eleventh, all lateral, and two large crescents on the hump of the twelfth, dorsally. When fully-grown, it forms a cocoon on a branch by fastening together many bits of cut-up leaves with their edges sticking out." The adults have creamy white heads; the size of the bright yellow spots on the hindwings varies considerably, as does also in details the pattern of purplish-brown and lavender of the forewings.

Calpe aequalis (Walker) is listed as an *Oraesia* from Puerto Rico by Herr Möschler and Dr. Gundlach.

Calpe excitans (Walker), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Oraesia metallescens* Guenée, an oriental species not found in the Americas, is recognized by Dr. Schaus (1940–259) from specimens intercepted at light at Bayamón.

Sudariophora fastigiata (Herrich-Schäffer), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Pseudocaple tristriga* H. S., was doubtfully identified by Dr. Schaus in 1923, specimens reared from undetermined host at Boquerón, as *Phiprosopus albiguttata* Herrich-Schäffer. The moths exhibit considerable variation in appearance, the hindwings and abdomen of some being dull yellow; the head, thorax and forewings light brown, with a diagonal, lighter-colored, stripe extending from the apex to about the middle of the inner margin of the forewing. Others are considerably darker, the diagonal stripe being merely the margin of the darker-colored marginal area. Some have a small white orbicular, others a darker one, and Dr. Schaus (1940–260) notes that Dr. Gundlach "thought that Herrich-Schäffer's three species, *albiguttata*, *fastigiata* and *tristriga* represented one species." The larvae, as noted in "Insectae Portoricensis" (1923–177), are looper caterpillars, about 30 mm. long, grey in general appearance due to irregular, waved, longitudinal, narrow stripes of yellow, or orange edged with yellow, alternating with broader stripes of greyish lavender margined with darker lavender. Two pairs of prominent yellow warts on the most elevated abdominal segments are covered with short fine brown hairs. Setae and their bases black. Head creamy and opalescent, with rows of aggregations of orange-yellow dots and dark brown ocelli, mouth-parts creamy and opalescent. They spin cocoons of light yellow silk, thick and roughly quadrangular, 6 x 20 mm. Adults have been collected at light at Coamo.

Antiblemma andersoni was described by Dr. Wm. Schaus (1940–261) from a drab-colored moth with a wing expanse of 19 mm. intercepted by

Mr. C. G. Anderson at light at Bayamon. Prof. Forbes has specimens from Cayey and Lares, the latter collected by Mr. Francisco Seín.

Antiblemma astyla was described from Puerto Rico as a *Capnodes* by Herr Heinrich B. Möschler (1890–215) from material collected by Dr. Gundlach. It has not been found since and Dr. Schaus (1940–261) is of the opinion that it "is the male of *A. sterope* (Cramer) or *A. rufinans* Guenée. Both species are common in Cuba."

Antiblemma anhypha (Guenée) is listed as a *Capnodes* from Puerto Rico by Herr Möschler and Dr. Gundlach.

Antiblemma concinnula (Walker) was re-described as *Capnodes priscilla* by Herr Heinrich B. Möschler (1890–216) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus (1940–260) recognizes it from fresh specimens from Lares.

Antiblemma marita, originally described by Dr. Schaus as a *Capnodes* from Cuba, is identified by him (1940–261), specimens from Coamo.

Antiblemma prisca, described by Herr Heinrich B. Möschler (1890–216), from material collected in Puerto Rico by Dr. Gundlach, as a *Capnodes*, is recognized by Dr. Schaus (1940–261): specimens from Coamo.

Antiblemma sterope (Cramer), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Capnodes*, has not recently been collected locally.

Massala obvertens (Walker), of which Herr Heinrich B. Möschler (1890–215) described the variety *insularis* of *Capnodes turtur* Felder and Rogenhofer from material collected in Puerto Rico by Dr. Gundlach, has since been found at Ensenda and Coamo, according to Dr. Schaus (1940–262), and collected at light at Dorado by Dr. Wm. A. Hoffman.

Euthermesia absumens (Walker) was re-described by Herr Heinrich B. Möschler (1890–263) under the name *Metallata variabilis*, and thus listed by Dr. Gundlach. It has not been found since locally.

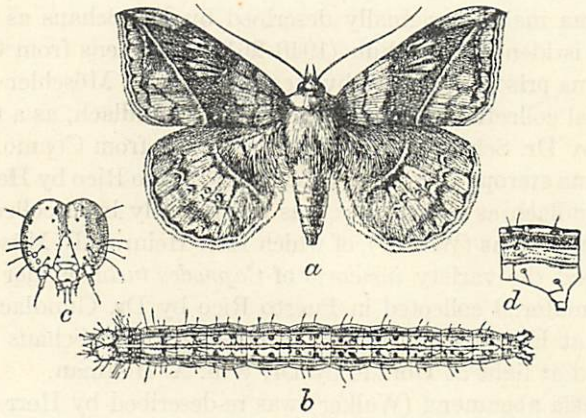
Bendis bayamona was described by Dr. Wm. Schaus (1940–264), "the male, with a wing expanse of 31 mm., very closely allied to *Bendis formularis* Hübner, distinguished by the underside of the forewing—hair brown, the inner margin narrowly whitish; the female nearer *Bendis irregularis* Hübner." Prof. Forbes considers this the Puerto Rican and Virgin Island race of the mainland *Bendis formularis*.

Bendis formularis Hübner was listed under this name by Herr Möschler and Dr. Gundlach, but Dr. Stahl had the name *Bendis impar* Guenée. Mr. E. G. Smyth took nine specimens of this "chocolate-brown barred Noctuid" at light at Hda. Santa Rita, Guánica, during October, November and December 1913, and two at Río Piedras in January 1917. It has been intercepted at light at Bayamón, and Dr. Schaus (1940–264) lists collections at Santurce, Coamo, Aibonito, Lares and Arecibo. Dr. Gundlach noted the larvae on *Cassia obtusifolia*, and they have been found at Río Piedras on "moriviví" or "sensitiva" (*Mimosa pudica*).

Bendis gurda Guenée, originally described from St. Thomas, was collected at light by Prof. J. A. Ramos (1947–46) at Sardinera Beach, Mona Island, as determined by Prof. Wm. T. M. Forbes. It has not been found in Puerto Rico.

Bendis magdalia Guenée, originally described from French Guiana, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach.

Anticarsia gemmatalis Hübner, the velvet bean or cowpea caterpillar, was listed from Puerto Rico by all the early entomologists as a *Thermesia*. According to Dr. Schaus (1940–206), it occurs from the United States to Paraguay, and in the Galapagos Islands. Outbreaks may occur at any point in Puerto Rico, the caterpillars having been found on alfalfa, peanuts and the foliage of the "gallito" tree (*Agati grandiflora*). Mr. H. K. Plank



The Velvetbean Caterpillar, *Anticarsia gemmatilis* Hübner: *a*, adult, *b*, larva from above, *c*, head of larva, *d*, one segment of larva, from the side. (After Chittenden, U. S. D. A.)

(1945–27) notes an outbreak on soybeans at Mayagüez, controlled by the fungus *Spicaria prasina* (Maubl.) Saw., but the identification by Miss Vera K. Charles of that eliminating outbreaks on this host at Isabela and at Loíza Aldea was *Spicaria rileyi* (Farl.) Charles, as recorded in "Epidemics of Fungus Disease Control Insect Pests in Puerto Rico" (Jour. Ec. Ent., 33 (1): 201–2. Menasha, February 1940). Under optimum weather conditions of high humidity and temperature for the development of this fungus, extensive outbreaks may be controlled with total efficiency. The diseased caterpillars crawl to outermost leaves or branches, and there immobilized, are soon covered with a greenish-white film of spores. On the contrary, during dry weather no fungus appears, and entire fields of cowpeas or velvet beans may be defoliated unless artificial means are taken. The appearance of these caterpillars is often so sudden that farmers have the

greatest difficulty in protecting their crops, but the present availability of DDT now makes artificial control comparatively simple. The caterpillars vary considerably in the amount of green, black and intermediate coloration they show, but rearing will indicate that they are all the same species. The adults also show considerable variation in both pattern and depth of coloration.

Anticarsia elegantula (Herrich-Schäffer), listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is by the latter thought "es probable que ésta y la especie precedente sean iguales." Prof. Forbes has a female collected by Mr. Francisco Seín at Lares which "fits this species or form, being pale, greenish, and lacking the white submarginal dots on under side."

Sylectra congemmalis Hübner, re-described as *Syllectra fictilina* by Herr Heinrich B. Möschler (1880–440), and listed from Puerto Rico by him and Dr. Gundlach, has not since been found locally.

Sylectra erycata (Cramer), listed from Puerto Rico by Herr Möschler and Dr. Gundlach, has been identified by Dr. Harrison G. Dyar (unlabeled specimen); by Mr. J. F. Gates Clarke, (a specimen collected at Río Piedras in August 1939) and intercepted at light at Bayamón. It has flattened antennae, combed on one side, ending in a curved whip; blood-orange wings, three transverse bands on the forewings, one more prominent on the hindwings. Dr. M. D. Leonard collected it on Vieques Island.

Sylectra lucifer as a *Syllectra* was described by Herr Heinrich B. Möschler (1890–267), and thus listed by Dr. Gundlach.

Ephyrodes cacata Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, has been recognized by Dr. Schaus (1940–267) from Coamo.

Azeta repugnalis (Hübner), listed by Herr Möschler and Dr. Gundlach from Puerto Rico, is recognized by Dr. Schaus (1940–268) from Aguirre, and has been collected at light, as identified by Prof. Wm. T. M. Forbes, by Prof. J. A. Ramos (1947–45) at Sardinera Beach, Mona Island.

Orthogramma coppryi Guenée, as *Thermesia icterodes* Felder and Rogenhofer, is listed by Dr. Gundlach from Puerto Rico, remarking "no observada por Krug ni por mí. Möschler no dice quién la cogió." It has not been found since.

Epidromia pannosa Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is recognized by Dr. Schaus (1940–269) from Catano and Coamo. It has also been intercepted at light at Bayamón.

Epidromia pyraliformis, as identified by Prof. Wm. T. M. Forbes, possibly a Walker species described from Santo Domingo, was collected at light by Prof. J. A. Ramos (1947–46) at Sardinera Beach, Mona Island.

Epidromia rotundata Herrich-Schäffer was listed from Puerto Rico by Dr. Stahl.

Focilla angularis was described from Jamaica by Herr Heinrich B. Möschler and identified by him from Puerto Rico, specimens collected by Dr. Gundlach, and listed by him.

Epitomiptera orneodalis (Guenée) was identified by Dr. Schaus as a *Tortricodes*: an inconspicuous little brownish moth of which Mr. E. G. Smyth had taken two at light at Hda. Santa Rita, Guánica in 1913, and of which Dr. Richard T. Cotton had reared a male from a larva on tomato, at Río Piedras. Dr. Schaus (1940–271) states "no males have been received from Porto Rico," having forgotten about the one he returned, and lists collections at Adjuntas and on El Yunque. A larva feeding on a papaya leaf, intercepted at Isabela, when reared to adult, proved to be this species, and in the Report of the Mayagüez Station for 1938 (1939–118) is the record of the larva of this little moth feeding on bamboo. To these varied host plants, Dr. Schaus adds lima beans.

Epitomiptera alucitalis (Guenée) is listed by Dr. Schaus (1940–271) from Lares.

Lophoditta tuberculalis (Herrich-Schäffer), re-described by Herr Heinrich B. Möschler (1890–230) as *L. perspicillaris*, and thus listed by Dr. Gundlach, is recognized by Dr. Schaus (1940–271): specimens from Lares.

Kyneria utuadae was described by Dr. Wm. Schaus (1940–272) from a type collected by Dr. Wm. A. Hoffman at Utuado: an olive colored moth with a wing expanse of 22 mm., "forewing below light mouse gray." It is presumed that this is what he had previously determined as *Epitomiptera pterophalis* Guenée, as listed in "Insectae Borinquenses" (1936–442).

Mastigophorus demissalis was described by Herr Heinrich B. Möschler (1890–233) from Puerto Rican material collected by Dr. Gundlach, and is thus listed by him. It has been intercepted at light at Bayamón, and collected at El Semil by Dr. W. A. Hoffman, as identified by Mr. J. F. Gates Clarke.

Mastigophorus jamaicalis Schaus is recognized by its describer (1940–272) from specimens taken at Lares and Adjuntas.

Hypenula complectalis Grote, as identified by Prof. Wm. T. M. Forbes, was found by Prof. J. A. Ramos (1947–46) "common at light, Sardinera Beach, April 4–7, June 29, July 20, 1944" on Mona Island. It is not reported from Puerto Rico.

Phlyctaina irrigualis was described by Herr Heinrich B. Möschler (1890–229) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus (1940–273) recognizes as this species specimens from Coamo.

Tetanolita mutatalis was described as a *Scelescepon* by Herr Heinrich B. Möschler (1890–230) from Puerto Rico, under which name it was listed by Dr. Gundlach. It has been repeatedly intercepted at light at Bayamón and Dr. Schaus (1940–273) lists additional collections at Río Piedras,

Dorado, Adjuntas, Aibonito, Coamo, Lares and San Germán. It is a small brownish moth, the female with darker brown triangles along the outer margin of the forewing, and one larger crescentric mark towards the center, the male having a complicated pattern of brown and grey.

Lophophora clanymoides was described by Herr Heinrich B. Möschler (1890–228) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus (1940–274) notes recent collections at Lares, Coamo and by Dr. W. A. Hoffman at Palmas Abajo, which is between Guayama and Jájome Alto. This moth has been repeatedly intercepted at Bayamón, and Prof. Forbes found it on Vieques Island.

Physula peckii was described by Herr Heinrich B. Möschler (1890–232) from Puerto Rican material collected by Dr. Gundlach. It has not since been found.

Carteris oculatalis was described as a *Zanclognatha* by Herr Heinrich B. Möschler (1890–225) from Puerto Rico, and it is thus listed by Dr. Gundlach. Altho with an extensive neotropical distribution, it has not since been found locally.

Bleptina acastusalis Walker, re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–219) as *Anagoa placidalis*, and thus listed by Dr. Gundlach, has not since been found here. It was originally described from Santo Domingo, and Prof. J. A. Ramos (1947–46) records the collection at light, of two specimens, as determined by Prof. Wm. T. M. Forbes, from Sardinera Beach, Mona Island.

Bleptina atymnusalis (Walker), a common species in Cuba, is recorded by Dr. Schaus (1940–275) from Ensenada, and by Prof. J. A. Ramos (1947–46) from Mona Island.

Bleptina araealis (Hampson) is identified by Dr. Schaus (1940–276) from Coamo.

Bleptina limatalis was described as an *Anagoa* by Herr Heinrich B. Möschler (1890–218) from Puerto Rico, and it is thus listed by Dr. Gundlach. Dr. Schaus had previously advised that it was a synonym of *B. menalcasalis* Walker, and it is thus listed in "Insectae Borinquenses" (1934–443). He has since identified females from Ensenada.

Bleptina nigromaculatalis was described by Herr Heinrich B. Möschler (1890–218) as an *Anagoa* from Puerto Rican material collected by Dr. Gundlach, and it is thus listed by him.

Bleptina priassalis Walker was re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–226) under the name of *Bleptina subjecta*, and it is thus listed by Dr. Gundlach. It has not since been found locally.

Aglaonice hirtipalpis (Walker), re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–227) under the name *Aglaonice*

snelleni, and thus listed by Dr. Gundlach, has not since been collected locally.

Mursa subrufa (Warren), re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–222) under the name *Sisputa gracilis*, and thus listed by Dr. Gundlach, is recognized by Dr. Schaus (1940–276) from specimens from Coamo, and those collected by Dr. Wm. A. Hoffman at Palmas Abajo, between Guayama and Jájome Alto. It was repeatedly intercepted at light at Bayamón, and identified under Möschler's name, as indicated in "Insectae Borinquenses" (1936–443).

Hormoschista latipalpis (Walker), re-described from Puerto Rico by Herr Heinrich B. Möschler (1890–221) as *H. pagenstecheri*, has not since been found locally.

Bomolocha conditalis, described by Herr Heinrich B. Möschler (1890–222) from Puerto Rico as a *Hypena*, and thus listed by Dr. Gundlach, is identified by Dr. Schaus (1940–277): a specimen from Coamo.

Bomolocha exoletalis (Guenée), listed as a *Hypena* by Herr Möschler and Dr. Gundlach from Puerto Rico, has not since been found locally.

Bomolocha umbralis Smith, re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–223) under the name of *Hypena cervinalis*, and thus listed by Dr. Gundlach, has been intercepted at light at Bayamón.

Ophiuche degesalis (Walker), re-described by Herr Heinrich B. Möschler (1890–224) from Puerto Rican material collected by Dr. Gundlach, under the name of *Hypena vinculalis*, has not since been found locally.

Ophiuche lividalis (Hübner), listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Hypena*, is recognized by Dr. Schaus (1940–279): a specimen from Lares. Prof. Forbes states that "this specimen is really **consilalis** Walker. I have *lividalis* only from Africa."

Ophiuche minualis (Guenée) was identified by Dr. Schaus in 1923 as an *Anepischetos*: two little brown moths reared by Mr. E. G. Smyth at Río Piedras during the summer of 1916 from "escoba" (*Sida carpinifolia* and *S. antillensis*). Prof. Forbes notes additional collections by Dr. Stuart T. Danforth at Cartagena Lagoon by Mr. Francisco Seín at Lares, and by himself with Dr. M. D. Leonard at Aguirre and Coamo.

Ophiuche porrectalis (Fabricius), originally described as a *Phalaena*, and re-described from Puerto Rican material by Herr Heinrich B. Möschler (1890–225) as *Hypena incertalis*, has been identified by Dr. Schaus (1940–279) from specimens collected at Aibonito, Coamo and Lares.

Notodontidae

Nystalea ebalea (Cramer) is listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga vive en *Comocladia* y en

Spondias." Prof. Wm. T. M. Forbes (1930–45) notes a recent collection at Coamo. Mr. Francisco Seín found an adult, as identified by Dr. Wm. Schaus, resting on the branch of a tree at Río Piedras, and another was intercepted at San Juan. This is a large brown moth with a wing expanse of over two inches, the apex of the forewing bluntly rounded "with a contrasting pale spot," the veins and margin of the hindwing also brown.

Purplish-red caterpillars, found resting on leaves of "tapón blanco" *Calypthranthes pallescens*, in Guajataca Gorge October 9, 1945, doubled up so that they resembled bird excrement, were possibly one of the following Notodontids, but were so small when found that they were not reared to adult. They had extremely large heads; elongate, narrow necks with an oval brownish mark dorsally; four sharply-pointed but fleshy humps on dorsum of body, and an even larger hump on the next to the terminal segment; much lengthened hind legs. Dorsally they are more or less spotted with whitish flecks.

Nystalea nyseus (Cramer) is listed from Puerto Rico by all the early entomologists, Dr. Stahl calling it a *Cyrrhesta*. It has not since been found locally.

Proelymniotis aequipars (Walker) was listed as *Nystales divisa* Möschler by Dr. Gundlach and Herr Möschler from Puerto Rico.

Rifargia distinguenda (Walker), a shining pale gray moth, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Symmerista dubia* Möschler.

Hippia insularis (Grote), listed as an *Edema* from Puerto Rico by Herr Möschler and Dr. Gundlach, is by the latter noted as "la oruga se crió en *Cupania.*" Prof. Wm. T. M. Forbes (1930–47) describes the moth as being "mottled, dull grey with a triangular whitish costo-apical shade; the apical area below is shaded with darker gray; 35 mm."

Sphingidae: Sphinx Moths

Herse cingulata (Fabricius) was listed from Puerto Rico by Dr. Stahl as a *Macrosila*, and by the other early entomologists as a *Sphinx*, Herr Möschler (1890–111) noting "Raupe auf Convolvulaceen: *Ipomaea batatas, trilobata, bona nox*, u. s. w." As *Phlegethontius convolvuli* Linn. it is mentioned by Mr. Thos. H. Jones (1915–7) as a pest of sweet potato of minor importance. In Van Zwaluwenburg's list it is number 918: on sweet potato. Adults quite often come to light, having been collected at Río Piedras, intercepted at Bayamón, while Prof. Wm. T. M. Forbes (1930–50) records it at Mayagüez and (1931–344) from Vieques Island, being "easily distinguished by the pink on the body" and on the hindwings. Mr. E. G. Smyth noted all all-devouring outbreak during December 1918 along the northwestern coast from Arecibo to Aguadilla, the caterpillars after having

eaten all the sweet potato leaves, and of such wild hosts as goat's food morning glory, attacked any other green vegetation available. "Farmers at Hatillo say that about December 10th the larvae were seen by millions, and that after devouring all sweet potato vines in one field, they migrated to another in hordes, crawling over one another "como un río de hormigas." Many were parasitized by Tachinid flies, *Belvosia bifasciata* F., but the caterpillars themselves are so large as to be avoided by all except such large birds as blackbirds and grackles. The farmers were helpless before such an invasion. No tests have since been made with DDT or other of the newer insecticides to determine if control might be possible if noted when the caterpillars were small, and before they had done much damage.

Cocytius antaeus antaeus (Drury), listed from Puerto Rico by all the early entomologists as an *Amphonyx*, is noted by Dr. Gunlach with "la oruga se cría en *Anona muricata*." Mr. E. G. Smyth found a partly grown larva on this host, "guanábana," at Río Piedras, heavily parasitized by *Apanteles* maggots, and had earlier found an adult in his room at the Casa Grande of Hda. Santa Rita, Guánica. Numerous adults have been taken at light at Río Piedras, and intercepted at Bayamón. They are by far the largest sphinx moths to be found in Puerto Rico, with wing expanse of seven and a half inches. Three segments of the abdomen have large lateral yellowish spots, and the base of the hindwing is yellowish; its outer half is dark brown, as are also the veins in the transparent inner portion; the forewings are grey, patterned in dark brown or black. Prof. Forbes (1930–52) notes that "the caterpillar has only the stripe leading to the horn, distinct."

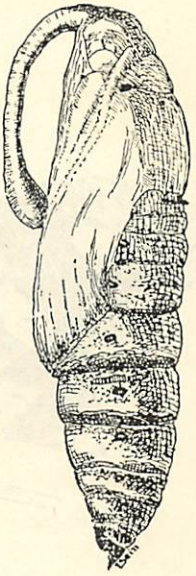
Cocytius cluentius (Cramer) as an *Amphonyx* was listed from Puerto Rico by all the early entomologists, and one unlabeled specimen is in the Río Piedras collection. The Rev. A. Miles Moss, of Belém do Pará, Brasil, (Nov. Zool., **28:** pl. 2. 1920) records the larva feeding on *Annona*, rarely on *Piper*.

Cocytius duponchel Poey, originally described from Cuba, "will certainly be taken in Porto Rico," according to Prof. Wm. T. M. Forbes (1930–51), but in fact has not been collected locally to date.

Phlegethontius (or **Protoparce**) **sextus** Johansson var. **jamaicensis** Butler, the tobacco or tomato hornworm, was listed from Puerto Rico by all the early entomologists; Drs. Stahl and Dewitz as *Macrosila carolina* L., and Herr Möschler and Dr. Gundlach as *Sphinx carolina* L., the latter noting "muy dañina al cultivo del tabaco, y en las huertas al tomate (*Lycopersicum*)." Mr. W. V. Tower (1908–36) found the eggs parasitized by *Telenomus monilicornis* Ashmead, but this seems to be its only recorded parasite. Mr. Arthur H. Rosenfeld, commenting on "The Food of Porto Rican Lizards" (Jour. Ec. Ent., **18** (2): 422–3. Geneva, April 1925),

describes the fight between an adult moth and the lizard *Anolis cristatellus*, which the lizard finally won. The caterpillars are eaten by the boat-tailed grackle or "mozambique," but not in such numbers as to be a serious limitation on their abundance. The eggs weigh 0.001 gr., and the just hatched larva 0.0004 gr., while the fully-grown larva weighs from 5.0 to over 6.0 gr., having eaten over 25.0 gr. of fresh tobacco leaves in attaining its growth. Two-thirds of the weight of the food has been voided as excrement. The adults weigh only a tenth as much as the food which the caterpillars consumed, as was shown in experiments conducted "On the

Egg, just-hatched caterpillar and fully-grown caterpillar of the Tobacco Hornworm, *Phlegethontius sextus jamaicensis* Butler, less than natural size. (Drawn by G. N. Wolcott.)



Pupa of the Tobacco Hornworm, less than twice natural size. (Drawn by F. Sein.)

Amount of Food Eaten by Insects" (Jour. Dept. Agr. P. R., 9 (1): 47–57, ref. 4. San Juan, January 1925). Despite the relatively enormous amount of food which one caterpillar destroys, the hornworm is normally not a serious pest in Puerto Rico. Most of the caterpillars are killed when still small by the constant application of insecticides for the control of fleabeetles and other pests, and laborers almost automatically destroy the hornworms in the course of their other work. On old tobacco left for seed, or on volunteer plants, or in abandoned fields, the caterpillars may strip the plants,

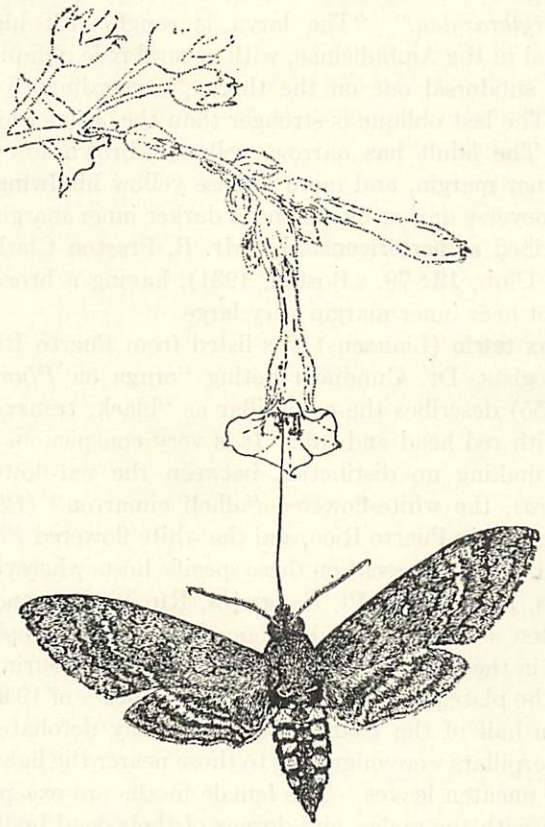
but strictly speaking, this is not commercial injury. In the same way, control is almost perfect in commercial tomato plantings, because insecticides must be applied for the control of other insect pests, and but rarely do hornworms even get started. The caterpillar may eat the leaves of *Solanum torvum*, as was first noted by Herr C. Moritz (1836–382) long ago, but this is quite exceptional, and such wild alternate hosts are of little importance. Moths have been taken at light in all parts of the Island, and Dr. Luis F. Martorell noted them at the lighthouse on Mona Island. These and other sphinx moths were so abundant, indeed, that Coast Guardsmen stationed there slept under mosquito-bars, not for protection

The "Mozambique": a natural enemy of the Tobacco Hornworm. (Drawn by F. Seín.)

against mosquitoes, but to prevent their sudden awakening by having these big moths descend upon them.

Phlegethontius rusticus rusticus (Fabricius) was listed from Puerto Rico by Dr. Stahl as a *Macrosila*, and by the other early entomologists as a *Sphinx*, Dr. Gundlach noting "la oruga vive en *Sesamum* y en *Tecoma stans*." It was listed from Mayagüez by Mr. R. H. Van Zwaluwenburg (P. R. 1431), and has been collected at light at Río Piedras by Mr. E. G. Smyth, as determined by him. It is somewhat larger than *P. jamaicensis*, its plump abdomen is less conspicuously marked with yellow spots, its forewings are extensively barred with white.

Phlegethontius brontes (Drury), of which Mr. B. Preston Clark as a *Protoparce* (New England Zoological Club, **4:** 100. Boston, March 21, 1919) described the variety **smythi** from Puerto Rico, the type from Río Piedras, September 1, 1916, collected by Mr. E. G. Smyth, was listed as *Sphinx brontes* Drury by all the early entomologists. It has since been



Adult of the Tobacco Hornworm, *Phlegethontius sextus jamaicensis* Butler, less than natural size. (Drawn by F. Seín.)

intercepted at Bayamon, and Prof. Forbes notes additional collections from San Germán and Coamo Springs. He writes: "After handling three specimens I think it more like a species than merely a race of *brontes*. The wings are much wider than of any other *Phlegenthontius* that I know, and it looks quite different." The adult has light grey forewings with an inconspicuous darker pattern; the hindwings are dark brown except for the anal angle. The specimen taken by Dr. Luis F. Martorell at Villalba has shorter wings

and a more sharply defined pattern on the forewings. The larva of the type form of this species, described from Jamaica, is similar to that of *P. jamaicensis*, but has orange spiracles, and according to Dr. Gundlach, feeds on *Tecoma*.

Protambulyx strigilis (Linnaeus) was listed from Puerto Rico by all the early entomologists, Dr. Gundlach noting "la oruga vive en *Comocladia* y también en *Erythroxylon*." "The larva is rough with high triangular head, as is usual in the Ambulicinae, with several pale oblique stripes, and a longitudinal subdorsal one on the thorax," according to Prof. Forbes (1930–55). "The last oblique is stronger than the others which sometimes are absent." The adult has narrow, yellowish-brown forewings, deeply cleft on the inner margin, and more intense yellow hindwings, with three irregularly transverse darker bands and a darker inner margin. The local race was described as **portoricensis** by Mr. B. Preston Clark (Proc. New England Zool. Club, **12:** 79. Boston, 1931), having a broad border, the antemedial spot near inner margin very large.

Pseudosphinx tetrio (Linnaeus) was listed from Puerto Rico by all the early entomologists, Dr. Gundlach noting "oruga en *Plumiera*." Prof. Forbes (1930–55) describes the caterpillar as "black, transversely striped with cream, with red head and tail. It is very conspicuous and feeds on frangipanni," making no distinction between the red-flowered "alhelí" (*Plumiera rubra*), the white-flowered "alhelí cimarron" (*Plumiera alba*), the common species in Puerto Rico, and the white-flowered *Plumiera obtusa* of Mona Island. Altho present on these specific hosts wherever they occur, as at Mameyes, Loíza Aldea, Pt. Cangrejos, Río Piedras, and Dorado, the caterpillars often assume outbreak proportions in the xerophytic regions, one at Ballena in the Guánica Forest having been noted during the summer of 1915. On the plateau of Mona Island in the spring of 1940 all the trees on the western half of the Island were completely defoliated, and many half-grown caterpillars were migrating to those nearer the lighthouse, which still had some uneaten leaves. The female moths are exceptionally large by comparison with the males, and dozens of their dead bodies were to be seen at the base of the lighthouse. At night, mingled with tobacco hornworm moths, they were a veritable pest, smashing into the panes of glass around the light, and disturbing the Coast Guardsmen sleeping in the rooms below. The moths are mostly light grey in color, marked with black, the male with "a conspicuous dark patch resting on the middle of the costa; the female is paler, much larger and without the patch."

Isognathus rimosa Grote, of which Mr. B. Preston Clark (Proc. New England Zoological Club, **8:** 8. Boston, January 1922) described the local variety as **wolcotti**, was listed from Puerto Rico by Dr. Dewitz as an *Anceryx*, and by Herr Möschler and Dr. Gundlach as a *Dilophonota*,

both noting that the larvae fed on the leaves of *Plumiera*. No specimens have been collected since that of the type of the variety, and that was an unlabeled specimen of which the locality of collection was unknown. "The caterpillar is striped irregularly in two shades of gray," according to Prof. Forbes (1930–56), "with irregular white lateral spots, and a filiform horn," the type form having first been described from Cuba.

Erinnyis alope (Drury) was first listed from Puerto Rico by Dr. Dewitz as an *Anceryx*, and by the other early entomologists as a *Dilophonota*, Dr. Gundlach noting "la oruga se cría en *Carica papaya*." According to Prof. Forbes (1930–57), the "caterpillar with black thoracic patch, including a red ring, and with a black lateral line," may also feed on cassava or "yuca" (*Manihot utilissima*). The caterpillars are by no means conspicuous, and even when the injury and their excrement on the ground underneath is obvious, one may experience considerable difficulty in detecting them. The parasitic wasp *Apanteles americanus* (Lepeletier) apparently has no such trouble, and the shining white cylinder of the combined cocoons of the hundreds of maggots which may develop in a single caterpillar is often found in plantings of papayas. Its value in control of the papaya sphinx is considerably limited, however, by the numerous hyperparasites which emerge from the cocoons of the parasite, and have often been confused with it. The sphinx moths has brown forewings, the inner margin often lighter in color; the hindwings are yellow with broad brownish margin.

Erinnyis crameri Schaus, first determined by Mr. E. G. Smyth comparing the specimen which he had taken at light at Río Piedras in 1916 with the illustration in Holland's "Moth Book," has since been intercepted at light at Bayamón, and Prof. Forbes (1930–59) notes collection at Ponce. Its body and forewings are quite dark, the inner margin much lighter; the hindwings are mostly a dark red (the color of raw meat), narrowly margined with brown. "Caterpillar with two red bars on thorax, the posterior bar with a black spot on it. Found on *Tabernaemontana" oppositifolia* or "pegoge."

Erinnyis ello (Linnaeus) is considered by Dr. W. J. Holland ("The Moth Book," p. 58) "quite the commonest of all the hawkmoths of the American tropics." It was listed from Puerto Rico as an *Anceryx* by Dr. Dewitz, and by all the other early entomologists as a *Dilophonota*, Dr. Gundlach noting "la oruga se cría en *Jatropha manihot*." He continues: "muchas orugas mueren, porque un himenóptero pequeño pone centenares de huevos en una sola oruga. Las larvas de estos himenópteros, que son *Microgaster flaviventris* Cresson, salen del cuerpo, cada una forma un capullito blanco uno al lado del otro y estos todos juntos parecen una mota de algodón, pegada en el peciolo u hoja de la planta." It is presumed that *Micro-*

gaster flaviventris is in synonymy with *Apanteles americanus* (Lepeletier), as this parasite has repeatedly been more recently identified. The caterpillars vary greatly in general appearance; those of the same size found at the same time may be green, brown or grey, with lateral stripes from head to horn and dark dorsal patch on thorax. The adults have hindwings of an ugly red, margined with black; the forewings are light grey, with inconspicuous pattern for the female, but with a dark, interrupted stripe from base to apex for the male. They have repeatedly been collected at light at Río Piedras, intercepted at Bayamón, and Prof. Forbes (1931–344) notes collection on Vieques Island, while Prof. J. A. Ramos (1947–47) found one at light on Sardinera Beach, Mona Island. Mr. Thos. H. Jones reared adults from larvae feeding on *Chamaesyce hyssopifolia* (or *Euphorbia hypericifolia*), and caterpillars are sometimes found also on papaya.

Erinnyis domingonis (Butler), as identified by Mr. B. Preston Clark, was collected at street light in the plaza of Río Piedras by Dr. Richard T. Cotton, May 21, 1917. By comparison with other moths of the genus, it is very small, with grey forewings and reddish hindwings, without appreciable pattern.

Erinnyis lassauxi (Boisduval) form **merianae** Grote was listed by the early entomologists from Puerto Rico, Dr. Gundlach noting "la oruga se cría en *Carica papaya*." It has not since been found locally.

Erinnyis obscura obscura (Fabricius) was listed from Puerto Rico by the early entomologists as *Dilophonota stheno* Hübner. Prof. Forbes (1930–59) records collection at Ponce and (1931–344) on Vieques Island, the larva feeding on *Gonolobus*.

Erinnyis oenotrus (Stoll) was listed from Puerto Rico by Dr. Dewitz as an *Anceryx*, and by the other early entomologists as a *Dilophonota*, but has not since been collected locally.

Pachylia ficus (Linnaeus) was listed from Puerto Rico under this name by the early entomologists, Dr. Gundlach noting "la oruga se cría en especies del género *Ficus*." At Río Piedras, the caterpillar has been noted on the leaves of the rubber tree, *Castilla elastica*, and also feeding on the leaves of the vine "yedra" (*Ficus pumila* or *Ficus repens*). It is somewhat more orange-yellow than the underside of the leaves of the latter host: a light green, almost entirely covered, except at sutures, with small yellow-orange spots, giving a roughened appearance. Two yellow lateral stripes start at the spinnerets and end at the short horn, and there are eight diagonal stripes on each side. The head is large and joined closely to the body, which is largest over the median prolegs. The younger caterpillars have six dark green dorsal spots. Adults have repeatedly been noted at light at Río Piedras, and are common everywhere on the Island, Prof. Forbes (1931–344) noting collections on Vieques Island and Prof. J. A.

Ramos (1947–47) on Mona Island. The anal angle of the dark brown and yellow hindwings is tipped with cream; the velvety brown forewing has a conspicuous eliptical light area at apex.

Madoryx oiclus (Cramer), a medium-sized Sphinx with lighter and darker grey forewings, deeply cleft on outer margin and with two silvery spots, was reared from a larva pupating under a rosebush at Río Grande.

Epistor lugubris (Linnaeus) is a dark grey sphinx with deeply cleft forewings and a small O-mark, repeatedly collected at light at Río Piedras. As an *Enyo* it was listed by all the early entomologists, Dr. Gundlach noting "la oruga vive en varias especies de *Cissus* o *Vitis*." The Rev. A. Miles Moss, of Belém do Pará, Brasil, (Nov. Zool., **27:** 397. 1920) figures the caterpillar, which has eight or nine oblique side-stripes and a complete subdorsal one.

Cautethia noctuiformis (Walker) was listed from Puerto Rico by Dr. Dewitz as an *Oenosanda*, and by Herr Möschler and Dr. Gundlach as *O. grotei* Henry Edwards. It is the smallest of the West Indian Sphingidae, with barred brown and grey forewings, the basal half of the hindwings yellow, the margin dark brown. It has been found at light on Mona Island by Dr. Luis F. Martorell, and in the Guánica Forest by Mr. Norberto Lugo. "Bejuco de berac" (*Chiococca alba*), a common xerophytic vine, present on Mona Island and extensively distributed in Puerto Rico, is the host for these caterpillars, as noted by Dr. Harrison G. Dyar.

Perigonia lusca (Fabricius), of which Prof. Forbes (1930–63) believes that the local form is *interrupta* Walker, was listed from Puerto Rico by the early entomologists, Dr. Gundlach noting "la oruga vive de *Genipa*, *Rondeletia*, *Gonzalea*, y otras rubiaceas." Indeed Prof. Forbes gives coffee as host for the green larvae "with seven side-stripes and a subdorsal stripe," and Mr. Cesario Pérez reared it on "palo pelado" (*Duggena hirsuta*) at Martín Peña. The costal margin and anal angle of hindwings of these moths is yellow, the broad outer margin a darker brown than on the body or the forewings. They have been taken at light at Río Piedras and Mayagüez.

Aëllopos blaini Herrich-Schäffer is listed from Puerto Rico by the early entomologists under the name *Macroglossa aedon* Boisduval, but has not since been found locally.

Aëllopos fadus (Cramer) was identified by Prof. Forbes (1930–64) from adults reared by Mr. Francisco Seín at Bayamón, from caterpillars on "jagua" (*Genipa americana*), of which half were parasitized by a species of *Apanteles*. The largest dark brown adult has a wingspread of two and half inches; its fourth abdominal segment is covered with white scales; of the two series of transparent spots on the forewing, those in the outer series number from four to seven, the inner series is in a double row.

Aëllopos titan (Cramer) was identified by Prof. Forbes (1930–64) from the same lot of reared material of which the others were called *A. fadus* by him, and considered "doubtless a straggler," quite ignoring the fact that all were reared from a single collection of eight caterpillars on a single host.

Aëllopos tantalus (Linnaeus) var. **zonata** (Drury) was listed from Puerto Rico by all the early entomologists, Dr. Gundlach noting "se cría en plantas de la familia de las rubiaceas, v. g. *Genipa*, *Randia*, *Alibertia*." Prof. Forbes (1930–65) records collections at five Puerto Rican localities, and notes that "the transparent spots on the fore wing" are in a single line and number but "three, the upper one largest, the middle normally smallest." These are day-flying moths, of which Dr. Luis F. Martorell noted one on flowers of *Moringa oleifera* on Mona Island in the spring of 1940.

Pholus fasciatus (Sulzer) was listed by all the early entomologists from Puerto Rico as a *Philampelus*, Dr. Gundlach noting "la oruga se cría en *Jussiaea*." It is P. R. 1426 in Van Zwaluwenburg's list. It has been repeatedly found on *Jussiaea*, at Río Piedras and at Martín Peña, Prof. Forbes (1930–66) noting the caterpillars as being "green, or red, black and white, or yellow, with eight slender oblique stripes." They did not happen to occur in the years when Prof. James G. Needham was making intensive observations on the primrose willow, and indeed have not been noted in the metropolitan area since 1923, but adults were collected at Mayagüez in 1927 and 1929, all three records being for the month of April. Adults have a broad, cream-colored "Y" extending from apex to base of the forewing; the anal and outer margins of the hindwing are bright pink.

Pholus labruscae (Linnaeus) is listed from Puerto Rico by all the early entomologists as a *Philampelus*, Dr. Gundlach noting "la oruga se cría en especies del género *Vitis*," and Van Zwaluwenburg giving it P. R. number 1425 in his list. It has been reared from larvae on the wild grape vine, *Cissus sicyoides*, at Isabela, and the beautifully shaded green and greenish-brown and greenish-pink adults have been repeatedly noted at light in the metropolitan area, intercepted at Bayamón, and reported by Prof. Forbes (1930–67) at Mayagüez and Ponce. While the curiously marked larvae doubtless would feed on the leaves of cultivated grape, they have not been found on it. Sometimes the adults by flight reach southern Canada and Patagonia. The caterpillars have "side patches very broad when young, (later) fusing into a broad vague pale shade, with only a little oblique mottling," according to Prof. Forbes.

Pholus vitis vitis (Linnaeus) is listed from Puerto Rico by all the early entomologists, Dr. Gundlach noting "la oruga se cría en *Cissus* (*Vitis*) *sicyoides*." Its larvae have not been found since locally, but adults, with pink only on the anal angle of the hindwing, have been noted at light at

Río Piedras and Mayagüez, and intercepted at Bayamón, and doubtless occur in all the more humid parts of the Island.

Xylophanes chiron (Drury) var. **nechus** (Cramer) was listed from Puerto Rico by Drs. Stahl and Dewitz as *Choerocampa nechus* Cramer, and by Herr Möschler and Dr. Gundlach as *Chaerocampa chiron* (Drury). The only recent collection, as identified by Mr. B. Preston Clark, was at light at Río Piedras, February 15, 1916, by Mr. E. G. Smyth, who described it as a "handsome green sphinx moth; primaries olive green with brown markings; secondaries rich brown with row of six pale yellow spots; body green with three brown spots on thorax and yellow-brown sides of abdomen." Prof. Forbes (1930–68) notes that the caterpillar has "red subdorsal ocelli on first two segments of abdomen and a yellow one on third; feeding on several Rubiaceae."

Xylophanes pluto (Fabricius) was listed from Puerto Rico by Dr. Dewitz as *Pergesa thorates* Hübner and by Herr Möschler and Dr. Gundlach as *Pergesa pluto*, the latter noting "la oruga se cría en *Erythroxylon*." To this, Prof. Forbes (1930–69) adds that the caterpillar has "the usual eye-spot on the first abdominal segment"; the adult with "green fore wings and yellow-centered hind wings." The most recent record of collection is by Mr. G. Navarrete, November 1, 1912, at light at Río Piedras.

Xylophanes tersa (Linnaeus) was listed from Puerto Rico by all the early entomologists as a *Chaerocampa*, and is in Van Zwaluwenburg's list as P. R. 1415, Dr. Gundlach noting "la oruga se cría en *Spermacoce*." Later called *Mitracarpus portoricensis*, this plant is now known as *Borreria verticillata*, the "botoncillo" of which the nectar of the flowers is so attractive to the wasps of the changa parasite, *Larra americana*, as well as to honey bees. It is a common plant, and the sphinx caterpillars which feed on its leaves, and the sleek and slender adults which develop from them are similarly common. A similar common plant, *Diodia sarmentosa*, as identified by Mr. J. A. Stevenson, was found by him being eaten by these caterpillars at Mameyes in January 1915. They are green above, laterally barred with yellow, which becomes confluent dorsally into continuous stripes ending posteriorly in a pointed hump; each yellow stripe ornamented with seven eye-spots decreasing in size posteriorly, the anterior ones largest, most brightly colored and most elaborate. The dark brown hindwings of the adults have a series of bright yellow submarginal spots; the forewings are a light greenish-brown with somewhat darker stripes approaching the apex; the very tapering abdomen dorsally of the same color is laterally light yellow. Adults have been taken at light in all parts of the Island, Prof. Forbes (1930–68) listing Ponce and Naguabo, and (1931–345) Vieques Island.

Celerio lineata lineata (Fabricius) was listed from Puerto Rico by Drs. Stahl and Dewitz as a *Deilephila*, and by Herr Möschler and Dr. Gundlach as *D. daucus* Fabricius, the latter noting "he cogido las orugas en *Oenothera* de los jardines, en *Claytonia perfoliata* y en *Boerhaavea*." This is P. R. 1424 in Van Zwaluwenburg's list. Altho sometimes found at light along the north coast, this is primarily a xerophytic or semi-xerophytic species, with many records from the south coast and from Mona Island. Prof. Forbes (1930–70) describes the caterpillars as "highly variable, green with red- or yellow-centered ocelli, or checkered with black and green, or largely black, with yellow dots in patches; head yellow, without black stripe across the mouth." No natural enemies have been noted in Puerto Rico, but in Hispaniola, the crows devour enormous numbers of these caterpillars, when they appear as outbreaks feeding on the weeds of *Boerhaavea* in cultivated fields. The wings of adults are often found in caves in Haiti frequented by insectivorous bats, but none of these or any other sphinx moth has been noted in bat caves in Puerto Rico. The forewings are brownish, with a broad light stripe extending from base to apex; the hindwings at base and marginally are dark brown, but the median area is bright pink.

Geometridae: Loopers or Measuring Worms

Dr. Wm. Schaus in his paper on the "Moths of the Families Geometridae and Pyralididae (Scientific Survey of Porto Rico and the Virgin Islands, 12 (3): 291–417. New York Academy of Sciences, New York, July 15, 1940) has provided a most modern systematic basis for the arrangement of biological data on these two families of moths. In the case of the Geometridae, this is rather insignificant in amount, for comparatively few rearings have been made, and indeed not much collecting of adults has been made in recent years. Dr. Schaus is continually in doubt as to the identity of many of these moths identified or described from Puerto Rico by Herr Möschler for this very reason; a condition which was finally resolved when the collections of the American Museum of Natural History in New York, and those of Cornell University made by Prof. Wm. T. M. Forbes, were available for his studies.

Ametris nitocris (Cramer) was listed from Puerto Rico as a *Mecoceras* by Herr Möschler and Dr. Gündlach. The MAC collection at Mayagüez contains specimens of local origin thus identified.

Almodes terraria Guenée, originally described from Haiti, and quite common in Cuba, is considered by Dr. Schaus (1940–292) to be what Dr. Gundlach collected in Puerto Rico, rather than the *Boarmia squamigera* Felder, a South America species, which was the identification given by Herr Möschler. Prof. J. A. Ramos (1947–47) found these moths, as identi-

fied by Prof. Wm. T. M. Forbes, abundant at light at Sardinera Beach, Mona Island in the summer of 1944.

Semaeopus caecaria Hübner was listed as *Zonosoma occipitraria* H. S. from Puerto Rico by the early entomologists, and Dr. Schaus (1940–293) notes recent collection from the Island of Vieques.

Semaeopus malefidaria was described as a *Cnemodes* by Herr Heinrich B. Möschler (1890–241) from material collected in Puerto Rico by Dr. Gundlach. It has since been found at San Germán, and on the Island of Vieques, as noted by Dr. Schaus (1940–293).

Semaeopus perletaria was described as a *Cnemodes* by Herr Heinrich B. Möschler (1890–240) from Puerto Rican material collected by Dr. Gundlach. It has not since been found anywhere.

Asellodes fenestraria Guenée is a very beautiful pinkish-white moth with irregular transparent golden areas on both fore and hind wings, identified by Dr. Harrison G. Dyar as a *Hydratoscia*, and thus listed by Mr. R. H. Van Zwaluwenburg (1601): on *Genipa americana*. Its distinctive caterpillars, found eating the leaves of this host locally called "jagua," at Río Piedras in the summer of 1921, and in the summer of 1942 at El Verde, Río Grande, have a dark purplish-brown head and five large irregularly rectangular spots of this color on the anterior abdominal segments, alternating with areas of the ground color of dull green; small purplish spots on the second and third segments, and smaller purplish spots on the other segments. They are very active when disturbed, jumping up and down very rapidly. Dr. Gundlach did not find this moth in Puerto Rico, and it may be a rather recent immigrant. Its caterpillars have been noted on the same host at Belém do Pará, Brasil, and its known distribution includes Mexico and Cuba.

Pleuroprucha pyrrhularia was described as an *Apallacta* by Herr Heinrich B. Möschler (1890–242) from Puerto Rican material collected by Dr. Gundlach, but has not since been found anywhere.

Pleuroprucha yunkearia was described by Dr. Wm. Schaus (1940–295) from a single female from El Yunque, with a wing expanse of 11 mm., its wings "pale yellow with roseate suffusions."

Pleuroprucha asthenaria (Walker), previously identified by Dr. Schaus from a single little yellowish moth reared from a two-horned pupa on a cane leaf at Yauco as *Hemiptilota insulsaria* Guenée and thus listed in "Insectae Borinquenses" (1936–454), has since been recognized by him (1940–295) from Aguirre, Coamo and San Germán. Prof. Forbes notes of this moth that "when fresh it is a very delicate pale green with some white."

Pleuroprucha molitaria was described by Herr Heinrich B. Möschler (1890–238) from Puerto Rican material collected by Dr. Gundlach. It

has been intercepted at light at Bayamón, and Dr. Schaus (1940–295) lists collections at Coamo, Aibonito, Lares and San Germán. The specimens which Dr. Schaus returned to the Cornell University collection were labeled **rudimentaria** Guenée, with *molitaria* indicated as a synonym.

Acratodes intamiataria was described by Herr Heinrich B. Möschler (1890–241) as a *Syllexis* from Puerto Rican material collected by Dr. Gundlach. It has not since been found anywhere.

Acratodes oslinaria was described by Dr. Wm. Schaus (1940–296) from numerous specimens "allied to *intamiataria* (Möschler)" from Cataño, Aibonito, San Germán and Ensenada, showing slight variation, with a wing expanse of 12 mm., "body and wings white with a few scattered irrorations; the wings crossed by two very fine brownish lines."

Acratodes oblinataria was described by Herr Heinrich B. Möschler (1890–239) as a *Leptostales*, and was thus listed from Puerto Rico by Dr. Gundlach.

Acratodes praepeditaria was described as a *Leptostales* by Herr Heinrich B. Möschler (1890–239) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus (1940–296) recognizes as this species specimens from Aguirre.

Acratodes virgota (Schaus) is recognized by its describer (1940–296) from Coamo and Ensenada.

Scelolophia delectabilaria was described as a *Zonosoma* by Herr Heinrich B. Möschler (1890–236) from Puerto Rican material collected by Dr. Gundlach. More recent collections have been made at Cataño, Coamo, Aibonito and Mayagüez, according to Dr. Schaus (1940–297).

Scelolophia phorcaria (Guenée), listed as an *Acidalia* by Herr Möschler and Dr. Gundlach from Puerto Rico, is recognized by Dr. Schaus (1940–298) from Coamo and Aguirre, and from Vieques Island.

Scelolophia randaria was described by Dr. Wm. Schaus (1940–298) from a single male with a wing expanse of 14 mm., from Coamo, with "head, metathorax and abdomen above, purplish red; wings pale pinkish yellow, the markings light russet vinaceous."

Scelolophia terminata (Guenée) was re-described under the name of *Leptostales devolutaria* by Herr Heinrich B. Möschler (1890–239), and as *Leptostales insutaria* (1890–240) from Puerto Rican material collected by Dr. Gundlach. It has since been intercepted at light at Bayamón and at Río Piedras, and Dr. Schaus (1940–298) cites additional collections at Aibonito, Coamo, San Germán, and on Vieques Island.

Scopula canularia (Herrich-Schäffer), as identified by Dr. Schaus (1940–300), has been collected at Coamo.

Scopula eburneata (Guenée), listed as an *Acidalia* by Herr Möschler and

Dr. Gundlach from Puerto Rico, is considered by Dr. Schaus (1940–299) as "undoubtedly one of the unfortunate mislabelings in the Staudinger Collection."

Scopula fernaria was described by Dr. Wm. Schaus (1940–200) from a single female intercepted at Bayamón, others from Coamo, with a wing expanse of 16 mm., which has the "head, thorax and abdomen pale smoke grey; wings white, finely irrorated with dark scales; a black discal point on both wings." Mr. Francisco Seín subsequently collected this moth at Lares, and Prof. Forbes at San Germán.

Scopula innominata was described by Dr. Wm. Schaus (1940–299) as differing, "according to Möschler, from *chioneata* Herrich-Schäffer by the absence of terminal black points on wings; the costa of the fore wing below, blackish gray," the type from San Germán, others from Ensenada, Ponce, Aguirre, Cataño and La Sardinera. "This is the whitest of the very small local geometers, and probably is the one formerly reported as *eburneata*," according to Prof. Forbes.

Scopula laresaria was described by Dr. Wm. Schaus (1940–300) from a single male from Lares, others from Coamo and Vieques Island, with a wing expanse of 12 mm., "thorax and abdomen white, the latter with grayish suffusions; wings white with black discal points."

Scopula subquadrata (Guenée) was described as *Acidalia tortuosaria* by Herr Heinrich B. Möschler (1890–237) from Puerto Rican material collected by Dr. Gundlach. It has not since been found locally.

Scopula umbilicata (Fabricius) is recognized by Dr. Schaus (1940–299) from Coamo, Guayanilla and Isabela. Prof. Forbes collected it on Vieques Island and at Aguirre.

Tricentrogyna floridora was described by Dr. Wm. Schaus (1940–301) from a single male from El Yunque, with a wing expanse of 13 mm., with a "fore wing long and narrow, the apex curved; ground color yellowish white rather thickly irrorated with vinaceous cinnamon scales."

Tricentrogyna vinacea (Butler), originally described as a *Hyria* from Jamaica, was re-described under the name of *Acidalia opentularia* by Herr Heinrich B. Möschler (1890–237) from Puerto Rican material collected by Dr. Gundlach. It was found at Utuado by Dr. Wm. A. Hoffman, intercepted at San Juan and Bayamón, and Dr. Schaus (1940–301) lists additional collections at Lares and on El Yunque. Prof. Forbes notes that the male is "rose with yellow border, the female looks totally different, being yellow with rose spots and patches."

Lobocleta dativaria was described by Dr. Wm. Schaus (1940–303) from a female from Coamo, others from Haiti, with a wing expanse of 15 mm., "wings silvery white with scattered fine irrorations."

Lobocleta maricaria was described by Dr. Wm. Schaus (1940–303) from a male from Coamo with a wing expanse of 16 mm., "wings silvery white, underneath the basal half of the fore wing suffused with gray."

Lobocleta monogrammata (Guenée) was recognized by Dr. Schaus (1940–303) from a single specimen from Coamo.

Lobocleta mutuataria was described as a *Leptostales* by Herr Heinrich B. Möschler (1890–239) from Puerto Rican material collected by Dr. Gundlach, but it has not since been found locally.

Lobocleta perditaria (Walker) was re-described under the name of *Acidalia offendata* by Herr Heinrich B. Möschler (1890–238) from material collected in Puerto Rico by Dr. Gundlach. It is recognized by Dr. Schaus (1940–302): a specimen from Coamo.

Sterrha curvicauda was described by Dr. Wm. Schaus (1940–304) from a male from Coamo, others from San Germán and Lares, and from Haiti, with a wing expanse of 13 mm., "fore wing silvery gray suffused somewhat with lilacine."

Ptychopoda monata was described by Prof. Wm. T. M. Forbes (*in* Ramos 1947–47) from an abundance of badly rubbed material collected on Mona Island by Dr. Luis F. Martorell, Prof. J. A. Ramos and Mr. J. A. Ferrer, 1939 to 1944, with a wing expanse of 11–12 mm., "luteous," "distinguished by the contrasting ordinary lines." This is the same genus as *Sterrha* used by Dr. Schaus.

Sterrha placitaria was described by Dr. Wm. Schaus (1940–304) from a female from Coamo with a wing expanse of 12 mm., "head, thorax and abdomen pale olive gray, partly irrorated with dull brown, the abdomen with transverse dark lines; wings grayish white with minute brownish irrorations."

Racheospila cupedinaria Grote is recognized by Dr. Schaus (1940–306) from collections made on Vieques Island, and in Puerto Rico at Lares and San Germán. Prof. J. A. Ramos (1947–49) found a single specimen, as determined by Prof. Wm. T. M. Forbes, at light, Sardinera Beach, Mona Island.

Racheospila gerularia (Hübner) was listed as *Geometra ocellata* Stoll from Puerto Rico by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Racheospila herbaria (Fabricius), re-described from Puerto Rico by Herr Möschler under the name of *Geometra attendaria* (1890–243), has not since been found locally.

Racheospila isolata Warren was described (Nov. Zool. **7:** 138. 1900) from Grenada and Puerto Rico.

Racheospila merlinaria was described by Dr. Wm. Schaus (1940–306) from a male from Vieques Island, others from Aibonito, Coamo, Manatí,

Río Piedras and Palmas Abajo (between Guayama and Jájome Alto, collected by Dr. Wm. A. Hoffman) and from San Germán, which has a wing expanse of 12 mm., wings, thorax and abdomen green, "shaft of antennae white."

Racheospila sanctae-crucis Prout is listed by Dr. Schaus (1940–305) from four Puerto Rican localities, and Prof. J. A. Ramos (1947–48) found it common on Mona Island.

Oöspila confundaria was described as a *Racheospila* by Herr Heinrich B. Möschler (1890–242) from material collected by Dr. Gundlach in Puerto Rico, but has not subsequently been found anywhere.

Phrudocentra centrifugaria (Herrich-Schäffer) was re-described from Puerto Rico by Herr Heinrich B. Möschler (1890–243) under the name of *Racheospila anomalaria.* Dr. Schaus identified as this species an unlabeled, faded green moth, beautifully mounted, and lists (1940–307) another from Lares.

Synchlora albicostaria (Herrich-Schäffer) as an *Eucrostis* is listed from Puerto Rico by all the early entomologists.

Synchlora frondaria Guenée is identified by Dr. Schaus (1940–308) from five Puerto Rican localities and from Vieques Island. It has been reared from larvae intercepted on "Tártago emético," at San Juan.

Chloropteryx paularia Möschler, originally described from Cuba and Jamaica, is identified by Dr. Schaus (1940–308) from Aguirre, Palmas Abajo (between Guayama and Jájome Alto), Jájome Alto, La Sardinera (Dorado), Coamo, San Germán and Ensenada, three of these collections having been made by Dr. Wm. A. Hoffman.

Phrygionis moeschleri Prout, listed by the early entomologists as *Eulepidotus cultraria* Hübner or *E. paradoxata* Guenée, is represented in recent collections by one specimen, which may be this species, or *P. polita* (Cramer) or *P. argentata* (Drury), all three of which names are listed by Herr Möschler and Dr. Gundlach as species of *Eulepidotus.*

Leuciris mysteriotis Prout is considered by Dr. Schaus (1940–310) what Herr Möschler and Dr. Gundlach report from Puerto Rico under the name of *Chrysocestis fimbriaria* Cramer.

Macaria adrasata (Snellen), originally described as a *Semiothisa* from Jamaica, is recognized by Dr. Schaus (1940–311) from Puerto Rico: one specimen from Coamo.

Macaria cellulata Herrich-Schäffer was listed as a *Semiothisa* from Puerto Rico by Herr Möschler and Dr. Gundlach. Dr. Schaus (1940–311) identifies as this species a specimen from San Germán.

Macaria diffusata Guenée is a "medium buff Geometrid" of which Mr. E. G. Smyth collected thirty specimens at light at Hda. Santa Rita, Guánica, during the summer and fall of 1913, identified by Dr. Harrison G. Dyar

as a *Semiothisa*. During the winter of 1915 he noted their larvae completely defoliating trees of "flamboyán" (*Delonix regia*) at Guánica, and in the summer of 1916 reared others to adult at Río Piedras. At that time, the latter specimens were returned by Dr. Schaus with the notation "*Semiothisa* sp., in Coll. unnamed," but he later (1940–312) identified specimens from Coamo and Ensenada. These are moths with a wing expanse of 22 mm., pale buff or slightly greenish yellow, the marginal areas of whose wings are slightly darker than the basal two-thirds.

Macaria everiata Guenée is identified by Dr. Schaus (1940–311): specimens from Coamo.

Macaria increta Walker was re-described as *M. bisignata* by Herr Heinrich B. Möschler (1890–248) from Puerto Rican material collected by Dr. Gundlach. It has not since been noted locally.

Macaria paelolata Guenée was re-described from Puerto Rico by Herr Heinrich B. Möschler (1890–248) under the name of *Semiothisa infimata*, and it is thus listed by Dr. Gundlach. Dr. Schaus has thus identified recently collected specimens from Coamo and Aguirre. Prof. Forbes found it on Vieques Island.

Macaria regulata (Fabricius) was re-described from Puerto Rican material collected by Dr. Gundlach under the name of *Semiothisa enotata* given by Herr Heinrich B. Möschler (1890–246). Dr. Schaus (1940–311) thus identifies subsequent collections at Coamo, Ponce and Ensenada. An unlabeled specimen, to which he had given Möschler's name, is creamy white, speckled with brown; hind wing strongly angled, forewing with anteapical brown band and spot. Another, which appears to be the same, was collected by Dr. Luis F. Martorell at Villalba.

Macaria trientata Herrich-Schäffer is identified by Dr. Schaus (1940–311) from Yauco.

Syrrhodia decrepitaria Hübner was listed as an *Acroleuca* from Puerto Rico by all the early entomologists, and Dr. Schaus (1940–312) identified a specimen from Coamo.

Numia terebintharia Guenée, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is identified by Dr. Schaus (1940–313): specimens from Ensenada and Coamo. Prof. J. A. Ramos (1947–49) collected several adults, as identified by Prof. Wm. T. M. Forbes, at light on Mona Island.

Cyclomia mopsaria Guenée, re-described from Puerto Rico by Herr Heinrich B. Möschler as *Cerasympiasta marsitata* (1890–261) and *C. sanata* (1890–262), is "an extremely variable species" according to Dr. Schaus (1940–314), who lists recent collections from Coamo and from Vieques Island.

Drepanodes infensata Guenée, altho listed by Herr Möschler and Dr. Gundlach from Puerto Rico, does not occur in any of the West Indies,

according to Dr. Schaus (1940–314) "and Möschler has probably misidentified the species." Prof. J. A. Ramos (1947–49) collected specimens at light, thus identified by Prof. Wm. T. M. Forbes, on Mona Island, which were *Halesa ephyrata* (Guenée), as redetermined by Prof. Forbes.

Möschleria hulstii Saalmüller (in Möschler 1890–235), the type from Puerto Rico, is listed by Dr. Gundlach, but no subsequent collection has been made.

Nepheloleuca complicata (Guenée), listed from Puerto Rico as a *Urapteryx* by Herr Möschler and Dr. Gundlach, has "a black point on angle of hind wing" according to Dr. Schaus (1940–135), who lists a recent specimen from Coamo.

Nepheloleuca politia (Cramer), listed from Puerto Rico as an *Urapteryx* by the early entomologists, is recognized by Dr. Schaus (1940–315): a pair from Coamo. This is a fine large sulfur yellow Geometrid, with a wing expanse of 48 mm., with minute dark spots and narrow cross-bars; poorly developed pinkish eye-spots on anal angles of both wings; similar semicircular pinkish area near apex of forewings and transverse submarginal band across hindwings.

Nepheloleuca illiturata (Guenée) is listed by Dr. Schaus (1940–315) from Puerto Rico: a Cuban species originally described as a *Urapteryx*.

Microgonia vesulia (Cramer), has a most misleading generic name, being possibly the largest Geometrid in Puerto Rico, some adults having a wing spread just short of three inches. Dr. Stahl lists it as *Oxydia quadriagliata* Guenée, and Herr Möschler and Dr. Gundlach used this generic name, the latter adding "estas especies varían muchísimo: Möschler describe diez variedades." In Van Zwaluwenburg's list it is P. R. 1450. Mr. E. G. Smyth collected six adults at light at Hda. Santa Rita, Guánica during the summer and fall of 1913, and they have repeatedly been intercepted at light at Bayamón. They are light yellowish-brown in color, with a darker stripe extending from the pointed and curved apex of the forewing to the middle of the inner margin of the hind wing. The caterpillar is a large grey looper, which, when at rest resembles a bare twig, being stiff and immobile, resting only on the anal prolegs. Mr. E. G. Smyth found one feeding on the ornamental *Acalypha wilkesiana* at Río Piedras, but apparently the caterpillars are not very particular as to host, for one has since been found feeding on the leaves of wild orange at Cayey, and one on cultivated rose at Aibonito, all of these having been reared to adult.

Sabulodes caberata Guenée, listed from Puerto Rico as *Microgonia dositheata* Guenée by Herr Möschler and Dr. Gundlach, is recognized by Dr. Schaus (1940–317): a specimen from Coamo.

Sabulodes exhonorata Guenée is listed by Dr. Schaus (1940–316) from Puerto Rico.

Pero rectisectaria Herrich-Schäffer was listed from Puerto Rico by all the early entomologists, Dr. Stahl using the name *Pero curvistrigaria* H. S.

Pero vetustaria (Walker) was identified by Dr. Schaus as an *Azelina*, as noted in "Insectae Borinquenses" (1936–452), and he notes (1940–317) another specimen from Coamo.

Apicia alteraria Guenée, listed as *Apicia distycharia* Guenée from Puerto Rico by Herr Möschler and Dr. Gundlach, does not occur in the West Indies, according to Dr. Schaus (1940–318), who believes "it is another case of wrong locality in the Staudinger Collection."

Gonorthus vestalis (Hulst), listed from Puerto Rico as *Sericoptera area* Cramer by Herr Möschler and Dr. Gundlach, has not since been found locally.

Halesa epionata (Guenée) is identified by Dr. Schaus (1940–319) from Puerto Rico: a specimen from Coamo.

Halesa ephyrata (Guenée), listed from Puerto Rico as a *Drepanodes* by Herr Möschler and Dr. Gundlach, is apparently quite common, Dr. Schaus (1940–319) noting collections at Ensenada, San Germán, Coamo, Aguirre and Palmas Abajo. It was this moth which Prof. J. A. Ramos (1947–49) collected at light on Mona Island, misidentified as *Drepanodes infensata* Guenée.

Sphacelodes vulneraria (Hübner) is listed as a *Brothis* from Puerto Rico by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Thysanopyga apicitruncaria Herrich-Schäffer is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, and Dr. Schaus (1940–320) records collection at Coamo.

Thysanopyga nicetaria (Guenée), originally described as a *Psamatodes* from Haiti, is identified by Dr. Schaus (1940–320) from Puerto Rico; a specimen from Coamo. He considers *T. subpusaria* (H. S.), listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the generic name of *Stegania*, to be a probable synonym. Prof. Forbes, examining his specimens from Coamo Springs, is of the opinion "that they are more probably *cyclata* (Walker 1862–1669), originally described from Santo Domingo as *Fidonia*."

Leucula simplicaria (Guenée), listed from Puerto Rico as a *Bombycodes* by Herr Möschler and Dr. Gundlach, has not since been found locally.

Bronchelia detexta Walker was listed from Puerto Rico as *Boarmia pudicaria* Guenée by the early entomologists, and Herr Möschler identified another "female with underside of hind wing ocher yellow" as *Boarmia scolopacea* Drury. Dr. Schaus (1940–322) is of the opinion that "these determinations are all wrong."

Iridopsis delicata (Butler) was listed from Puerto Rico as a *Boarmia*

by Herr Möschler and Dr. Gundlach, but no specimen has since been found locally.

Iridopsis momaria (Guenée), listed as a *Boarmia* from Puerto Rico by Herr Möschler and Dr. Gundlach, as which Dr. Schaus identified a specimen as an *Alcis*, reported in "Insectae Borinquenses" (1936-452), "does not agree with Guenée's excellent figure" according to Dr. Schaus (1940-323).

Iridopsis hilararia was described by Herr Heinrich B. Möschler (1890-266) from Puerto Rican material collected by Dr. Gundlach, and thus listed by him, but has not since been found anywhere.

Iridopsis idonearia (Walker) was listed from Puerto Rico as *Boarmia objectaria* H. S. by Herr Möschler and Dr. Gundlach, and Dr. Schaus (1940-323) lists subsequent collections at Ensenada, Coamo and Aguirre.

Thyrinteina arnobia (Cramer), listed from Puerto Rico as *T. quadricostaria* H. S. by Herr Möschler and Dr. Gundlach, has not since been found locally.

Scordylia quadruplicaria (Hübner), listed from Puerto Rico by Herr Möschler and Dr. Gundlach, does not occur in the West Indies, according to Dr. Schaus (1940-324).

Melanchroia cephise (Stoll) was not listed from Puerto Rico by any of the early entomologists, the first record being in Van Zwaluwenburg's list as number 1663: on *Phyllanthus lathyroides*, and in his account, Mayagüez Station Report for 1914 (1916-31) of "a local outbreak at Camuy, where the larvae practically stripped the grosella trees, *Phyllanthus distichus*." At the same time, Mr. Thos. H. Jones noted an outbreak at Río Piedras, and two years later, in the summer of 1916, Mr. E. G. Smyth a comparable one on "grocella" or "cereza amarilla" (*Cicca disticha*). The dark adults, their rounded wings apically margined with cream, plumed antennae and chestnut collar, were first noted on weeds in cane fields at Río Piedras in January 1912, and have since been seen repeatedly on flowers of "botoncillo" (*Borreria verticillata*), most recently at Yabucoa in 1939. The moths rarely come to light, but have been intercepted at Bayamón and at Peñuelas, and are presumably present in all parts of the Island, despite the scarcity of records in recent years.

Hammaptera chloronotata was described by Herr Heinrich B. Möschler (1890-273) from Puerto Rican material collected by Dr. Gundlach. Dr. Schaus (1940-325) lists a recent collection from Utuado.

Hammaptera moeraria (Guenée) is listed by Dr. Schaus (1940-325) from Puerto Rico.

Hammaptera vinaceata was described as a *Cidaria* by Herr Heinrich B. Möschler (1890-273) from Puerto Rican material collected by Dr. Gundlach, but has not since been found anywhere.

Pterocypha praecurraria was described as a *Spargania* by Herr Heinrich B. Möschler (1890-269) from Puerto Rico, and thus listed by Dr. Gundlach. Dr. Schaus (1940-326) recognizes as this species a specimen from Adjuntas.

Pterocypha defensata Walker, as determined by Dr. Schaus, was collected by Mr. E. G. Smyth at light, Hda. Santa Rita, Guánica, on October 2nd., November 19th. and 26th., 1913. Dr. Schaus (1940-326) notes an additional collection at San Germán. This is a greyish moth, its rounded wings with darker wavy lines, a dark spot at base and apex of forewings, a wing expanse of 30 mm.

Camptolina stellata (Guenée) was listed as *Cidaria balteolata* H. S. from Puerto Rico by Herr Möschler and Dr. Gundlach, and as a *Larentia* by Dr. Stahl. Recent collections identified by Dr. Schaus (1940-327) have been made at Coamo and Aguirre, and on Vieques Island.

Rhopalodes castniata Guenée, altho listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is a Brasilian species, according to Dr. Schaus (1940-327), to which the wrong locality label was attached in the Staudinger Collection.

Graphidius aureocapitaria was described as a *Terenodes* by Herr Heinrich B. Möschler (1890-274) from Puerto Rican material collected by Dr. Gundlach, but it has not since been found anywhere. Dr. Stahl has the name *Terenodes mirandilis.*

Cambogia snellenaria was described as an *Asthena* by Herr Möschler, are listed by him and Dr. Gundlach from Puerto Rico, but has not since been found locally.

Epiplemidae

Nedusia excavata was described by Herr Heinrich B. Möschler (1890-244) from Puerto Rican material collected by Dr. Gundlach, and thus listed by him. The adult is "ash gray, with dark brown markings, the median line of the hind wing whitish, edged with dark brown, and bent at a right angle" according to Prof. Forbes (1930-71), who records a recent collection at Coamo, and (1931-345) at Jájome Alto.

Syngria ramosaria and **Syngria reticularia** were described by Herr Heinrich B. Möschler (1890-256) from Puerto Rican material collected by Dr. Gundlach, and listed by him, but neither has since been found anywhere.

Epiplema ecludaria and **Epiplema obvallataria** were described as belonging in genus *Erosia* by Herr Heinrich B. Möschler (1890-262 and 263) from Puerto Rican material collected by Dr. Gundlach, and thus listed by him. Neither has since been found locally.

Epiplema ineptaria was described by Herr Heinrich B. Möschler (1890-262) as an *Erosia* from Puerto Rico, and it is thus listed by Dr. Gundlach.

Prof. Forbes identifies (1930-72) as this species specimens collected at Coamo and San Germán.

Letchena myreusalis Walker, as identified by Dr. Wm. Schaus, was intercepted at light at Bayamón.

Pyralidae or Pyralididae: Snout Moths, Webworms, Leaf-Folders and Leaf-Tiers

Practically all of the new rearing and host records in this section are due to Dr. Luis F. Martorell, many of these being first reported by him in "Some Notes on Forest Entomology" (Caribbean Forester, **1** (2): 25–26, **1** (2): 31–32, **1** (3): 23–24, **2** (2): 80–82. New Orleans, October 1939, January and April 1940, and January 1941). These observations, and others made by him in succeeding years, formed the field work for his doctorate thesis, "A Survey of the Forest Insects of Puerto Rico" (Jour. Agr. Univ. P. R., **29** (3 and 4, July and October 1945): 69–608, fig. 18, pl. 21. Río Piedras, September 30, 1948), interminably delayed in publication and unfortunately not available for consultation until after this section had been written. It may be presumed, therefore, that all records of leaf-folders and leaf-tiers attacking forest trees, here reported as having been made by Dr. Martorell, were previously recorded in this thesis.

Subfamily Glaphyriinae

Glaphyria badierana (Fabricius) is listed as a *Homophysa* by Dr. Schaus (1940–329) from Coamo in Puerto Rico, and from Vieques Island. The Cornell University collection contains specimens, as identified by Prof. Forbes, collected by Dr. M. D. Leonard at Aguirre, by Dr. W. A. Hoffman in Santurce and by Mr. Francisco Seín at Lares.

Glaphyria dolatalis was described by Herr Heinrich B. Möschler (1890-321) from Puerto Rican material collected by Dr. Gundlach, and listed by him. Adults have repeatedly been intercepted at light at Bayamón, and Dr. W. A. Hoffman found it at Utuado and at El Semil. Dr. Schaus (1940-330) notes that "this species is much more abundant than *H. badierana* (Fabricius)," and lists additional collections from Aguirre, Coamo, San Germán, Lares and El Yunque, as well as from the Islands of Vieques and Culebra.

Symphysa amoenalis (Walker) is identified by Dr. Schaus (1940-331) from Puerto Rico: two specimens from Coamo.

Lipocosma hebescalis was described by Herr Heinrich B. Möschler (1890-316) from Puerto Rican material collected by Dr. Gundlach, and listed by him. Adults have been intercepted at light at Bayamón, and Dr. Schaus (1940-331) lists additional collection on El Yunque.

Lipocosma metalophota (Hampson) is recognized by Dr. Schaus (1940-331) from Puerto Rico: adults collected by Dr. W. A. Hoffman at La Sardinera, Dorado.

Lipocosma savoralis Schaus, originally described from Cuba, also occurs in Puerto Rico according to the describer (1940-331), recognizing an adult from Lares.

Dicymolomia pegasalis (Walker); as identified by Mr. Carl Heinrich, was intercepted on "roble" (*Tabebuia pallida*) at San Juan.

Chalcoëla discedalis was described by Herr Heinrich B. Möschler (1890-320) from two males and a female collected in Puerto Rico by Dr. Gundlach, and listed by him. Dr. Schaus (1940-402) lists later collections at Manatí and Lares, and from Vieques Island. Prof. Forbes suggests a generic transfer to *Dicymolomia*.

Subfamily Pyraustinae

Hymenia recurvalis (Fabricius) was listed as a *Zinckenia* from Puerto Rico by all the early entomologists, Dr. Gundlach noting "la oruga se cría en *Amaranthus y Celosia*." As **Zinckenia fascialis** (Cramer) it is in Van Zwaluwenburg's list; Mr. Thos. H. Jones (1915–8) notes its larvae feeding on *Amaranthus*, and Dr. Richard T. Cotton (1918–8) as "webbing and skeletonizing the leaves of beets." Dr. M. D. Leonard (1932–115) under the generic name of *Hymenia*, records collecting adults at light at Aguirre, and finding larvae on beets and Swiss chard at Palo Seco, and on *Gomphrena dispersa*. During the summer, fall and early winter of 1913, Mr. E. G. Smyth collected eighty-six of these "spotted brown Pyraustids" at light, Hda. Santa Rita, Guánica, they being possibly more abundant than any other moth found at that time. It has also been taken at light at Río Piedras, and repeatedly intercepted at Bayamón, being, as Dr. Schaus (1940–332) notes, "almost universally distributed," with collections from seven additional localities in Puerto Rico as well as in Vieques Island. The collar and posterior margin of the abdominal segments are white, as is also a broad band halving both golden-brown wings, and a shorter band on the forewings half-way towards the apex.

Hymenia perspectalis (Hübner) has much narrower, wavy white bands on its brown wings. It was listed from Puerto Rico by Dr. Gundlach, without any note as to the host plants of the larvae, but Herr Möschler states "Raupe nach Guenée am Lilium canadense, Burg vermutet sie an Cestrum parque und an Saplichroa rhomboida." Dr. E. G. Smyth reared larvae at Río Piedras on *Synedrella nodiflora*, *Eleutheranthera ruderalis*, *Wedelia trilobata*, *Verbesina alba* and *Melanthera canescens*, having previously collected seventy-five adults, as determined by Dr. Harrison G. Dyar, at light at Hda. Santa Rita, Guánica, during the latter half of 1913.

Pycnarmon receptalis (Walker) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name *Spilomela personalis* H. S., but has not since found locally.

Desmia naclialis Snellen, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, has been collected by Dr. W. A. Hoffman at El Semil, determined as "probably" by Mr. Carl Heinrich.

Desmia recurvalis was described by Dr. Schaus (1940-334), the type specimen from Cuba, a battered one from Puerto Rico, with a wing expanse of 27 mm., mostly "sepia" in color, with white markings.

Desmia stenizonalis Hampson is listed by Dr. Schaus (1940-334) from Puerto Rico.

Desmia tages (Cramer) is listed from Puerto Rico under this name by Dr. Stahl, and as *Desmia sertorialis* H. S. by Herr Möschler and Dr. Gundlach. It is identified by Dr. Schaus from five Puerto Rican localities.

Desmia ufeus (Cramer) was listed from Puerto Rico as *Desmia orbalis* Guenée and re-described by Herr Heinrich B. Möschler (1890-311) under the name of *Desmia viduatalis*; and under both these names, not in synonymy, listed by Dr. Gundlach. The irregular, iridescent white bands on its wings are so extensive as sometimes to cover more than half of their area. Mr. J. D. More reared to adult some larvae feeding on the leaves of the wild grape, "bejuco de caro" (*Cissus sicyoides*) at Río Piedras, finding some of them parasitized by *Apanteles ruficollis* (Cameron), as identified by Mr. C. F. W. Muesebeck. Mr. Carl Heinrich identified adults collected at El Semil by Dr. W. A. Hoffman, and Dr. Schaus (1940-332) lists collections at Aguas Claras (Fajardo), Manatí, Cayey, Aibonito and San Germán. Prof. Forbes found it on Vieques Island.

Synclera traducalis (Zeller) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach. Twenty-four adults of this "white and brown Pyraustid," as idenified by Dr. Harrison G. Dyar, were collected by Mr. E. G. Smyth at light at Hda. Santa Rita, Guánica, during the latter half of 1913. It has been intercepted at Bayamón, and Dr. Schaus (1940-335) lists additional collections at San Germán, Coamo, Manatí, Lares, and Guayama. The adult is more white than brown, its wings having oval or irregular-shaped white areas bounded by narrow brown lines.

Ercta vittata (Fabricius) was re-described by Herr Heinrich B. Möschler (1890-302) from Puerto Rican material collected by Dr. Gundlach under the name of *Euclasta torquillalis*. Mr. E. G. Smyth collected eight adults of this "small buff-brown Pyralid" at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and Dr. Schaus (1940-336) lists additional collections at San Germán and Guayama, and on Vieques Island. It has been intercepted once at San Juan. The legs and the posterior half of the

forewings are cream in color, the anterior half is dark brown, with small black spots along the margin.

Marasmia cochrusalis (Walker) was re-described by Herr Heinrich B. Möschler (1890-293) from Puerto Rican material collected by Dr. Gundlach under the name of *Cnaphalocrocis perpersalis*. Mr. Francisco Seín reared adults from corn leaves; the delicate whitish moths have been intercepted at light at Coamo and on Vieques Island. The eyes of this moth are black; the fore margin of the fore wing is light brown, as are also narrow submarginal and marginal bands, and three bands on the hind wings, but otherwise it is whitish.

Marasmia similis (von Hedemann), originally described as a *Cnaphalocrocis* from St. Croix of the Virgin Islands, was first noted economically as "A Pyralid-Pyraustinid larva attacking the Leaves of Sugar-Cane in Hispaniola" (Jour. Ec. Ent., **18** (2): 422. Geneva, April 1925). "*Marasmia trapezalis* Guenée on Sugar-Cane only in Hispaniola and Perú of the Western Hemisphere" (Jour. Ec. Ent., **22** (1): 268–9. Geneva, February 1929) records a further extension of its range. In "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields" (Jour. Agr. Univ. P. R., **27** (2, April 1943): 85–104, fig. 12, ref. 16. Río Piedras, June 1944), it is noted as a leaf-tier which feeds on the tips of the leaves of young cane, "ruining the appearance of young fields, but at present of no economic importance in Puerto Rico because of its scarcity. The first record of this insect in Puerto Rico was at Barrio Camaseyes, Aguadilla, in July 1931, a single caterpillar only in a large cane field. Reared to adult, it was determined by the late Dr. William Schaus as *M. similis* von Hedemann. The type of *M. similis* is from St. Croix, but in economic literature it has not been recorded from there as a pest of sugar cane. Mr. Carl Heinrich states that the specimen identified by Dr. Schaus 'agrees in all details with typical *trapezalis*,' altho it is considerably darker and richer in color. "Our records in Puerto Rico would appear to indicate its recent arrival from Hispaniola: very abundant in Barrio Aguacate, Aguadilla in October 1936, as well as in another field near Camuy; also very abundant in two fields at Guánica in November 1939, and in a field at Yauco in December 1936, and in one at Sabana Grande in the same months in 1937. The only other record of its presence is in July 1937 at Guayanilla. All of these localities are on or near the west coast of Puerto Rico, closest to Hispaniola."

Marasmia trapezalis (Guenée) is noted by Dr. Schaus (1940-337) as being "widely distributed," definitely recorded from Vieques and from Cuba. If present in Cuba, it has not been noted as occurring on sugar-cane. Adults intercepted at light at Bayamón have been identified by Dr. Schaus as this species. The most recent record is of a very light colored adult, reared from leaves of sugar-cane at Río Piedras, growing in the Station

greenhouse, found in May 1944. All specimens are similar in the brownish costal and outer margins of the fore wing, and the pattern of one entire and two interrupted darker brown bands, but vary considerably in depth of coloration. On the assumption that Mr. Carl Heinrich is correct in his synonymy, all of the records under *M. similis* (von Hedemann) described in 1894 are to be assigned to *M. trapezalis* (Guenée) described in 1854.

Syngamia cassidalis (Guenée) was re-described by Herr Heinrich B. Möschler (1890-291) from Puerto Rican material collected by Dr. Gundlach under the name of *Salbia praeformatalis*. It has been intercepted at light at Bayamón, and Dr. Schaus (1940-337) records collection at Coamo.

Syngamia cognatalis (Snellen) was listed as a *Salbia* from Puerto Rico by Herr Möschler and Dr. Gundlach. The Cornell University collection contains a series of specimens labeled "*Marasmia conflictalis* Schs." including one labeled "cotype" from Lares collected by Mr. Francisco Seín, others from Maricao, Coamo, Cayey and El Yunque. Prof. Forbes thinks these were not described by Dr. Schaus, but probably represent what Herr Möschler and Dr. Gundlach report under the name of *cognatalis*.

Syngamia florella (Cramer) was listed from Puerto Rico by all the early entomologists. It is a very distinctive little brownish moth, with three large golden yellow spots on the fore wing, two on the hind wing, and an orange-yellow abdomen. It has an extensive distribution in tropical America, according to Dr. Schaus (1940-338), who lists it from nine Puerto Rican localities in the more humid and mountainous parts of the Island from El Yunque to Mayagüez. An adult was intercepted on ñame at Isabela, which may indicate the host plant of the caterpillar.

Syngamia haemorrhoidalis (Guenée) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, and Dr. Schaus (1940-338) notes subsequent collection at San Germán, Lares, Aibonito and Coamo.

Syngamia varanalis was described by Dr. Wm. Schaus (1940-338), the type from Coamo, with a wing expanse of 19 mm., the head, front of collar, patagia and base of abdomen white; fore wing white, the lines black.

Hileithia ductalis was described by Herr Heinrich B. Möschler (1890-292) from Puerto Rican material collected by Dr. Gundlach. It has been repeatedly intercepted at light at Bayamón. Dr. W. A. Hoffman collected adults at Utuado, and Dr. Schaus (1940-339) records additional collections from El Yunque, Río Piedras, Coamo and Mayagüez.

Samea carettalis was described by Dr. Wm. Schaus (1940-340), the type from Jamaica, others from San Germán, Maricao, Lares, Aibonito, Jájome Alto and El Yunque in Puerto Rico, both sexes having a wing expanse of 18 mm. The sexes of this mountainous species differ considerably, only the fore wings being similar in markings.

Samea ecclesialis Guenée was listed from Puerto Rico by all the early

entomologists, thus or as *Samea castellalis* Guenée. It has repeatedly been intercepted at light at Bayamón, and Dr. Schaus (1940-339) lists nine other localities of collection in the more humid parts of the Island. Broad and narrow brown bands alternate with iridescent clear areas on the fore wings.

Samea mictalis Hampson is identified by Dr. Schaus (1940-339) from Coamo and Arecibo.

Samea multuplicalis Guenée, as identified by Prof. Wm. T. M. Forbes, was found by Prof. J. A. Ramos (1947-49) abundant at light in April 1944 on Sardinera Beach, Mona Island.

Trithyris quadrifenestralis (Herrich-Schäffer) was listed from Puerto Rico as a *Coenostola* by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Bocchoris differentialis Dyar, as identified by Mr. Carl Heinrich, was collected at light at El Semil, Villalba by Dr. W. A. Hoffman.

Pilocrocis delimitalis (Guenée), re-described from Puerto Rico as *Ceratoclasis metatalis* by Herr Heinrich B. Möschler (1890-307) from two males in the Krug collection, and a female in that of Dr. Staudinger, and thus listed by Dr. Gundlach, is recognized by Dr. Schaus (1940–342): a series from Coamo, collected by Prof. Forbes.

Pilocrocis dryalis (Walker), as determined by Mr. Carl Heinrich, was collected by Dr. W. A. Hoffman at El Semil, Villalba, on May 10th, 1941.

Pilocrocis hesperialis (Herrich-Schäffer), originally described from Cuba and quite common there, is recognized by Dr. Schaus (1940-342) from Puerto Rico: a specimen from Aguirre.

Pilocrocis infuscalis (Gueneé) was listed from Puerto Rico as *Botys pruinalis* Lederer by Herr Möschler and Dr. Gundlach. Dr. Schaus (1940-343) notes a more recent collection, from Coamo.

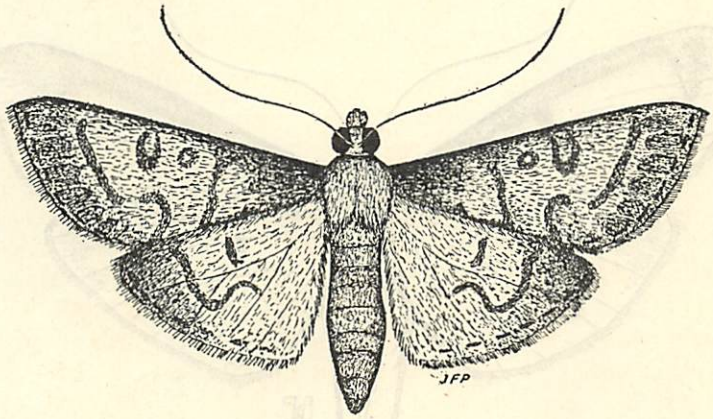
Pilocrocis "presumably *inguinalis* (Guenée) but somewhat abnormal" as identified by Mr. Carl Heinrich, is called the "higüerillo leaf-webber" by Dr. Luis F. Martorell, who found the larvae causing heavy defoliation of *Vitex divaricata* at Cayey in January 1941. It is a pale yellowish moth, with three narrow wavy and somewhat interrupted bands on the fore wing, and two on the hind wing.

Pilocrocis lauralis (Walker) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Spilomela pervialis* H. S. It has been intercepted at light at Bayamón, and Dr. Schaus (1940-342) notes collection at Coamo. It is quite common on Mona Island, having been collected at light at Camp Kofresí by Dr. Luis F. Martorell in August 1939, with identification by Mr. Carl Heinrich, and at the same locality by Prof. J. A. Ramos, (1947-49) in March 1944. The brown bands on both fore and hind wings are arranged as somewhat distorted Ws.

Pilocrocis pertentalis was described by Herr Heinrich B. Möschler (1890-284) as a *Botys*, and thus listed by Dr. Gundlach, who had several specimens of both sexes from Puerto Rico. Dr. Schaus (1940-343) notes subsequent collection at Ensenada and on Vieques Island.

Pilocrocis ramentalis Lederer is recognized by Dr. Schaus (1940-343) from Puerto Rico: a specimen from Coamo.

Pilocrocis secernalis was described from Puerto Rico as a *Botys* by Herr Heinrich B. Möschler, and is thus listed by Dr. Gundlach. Dr. Schaus (1940-343) records collection from San Juan and San Germán.



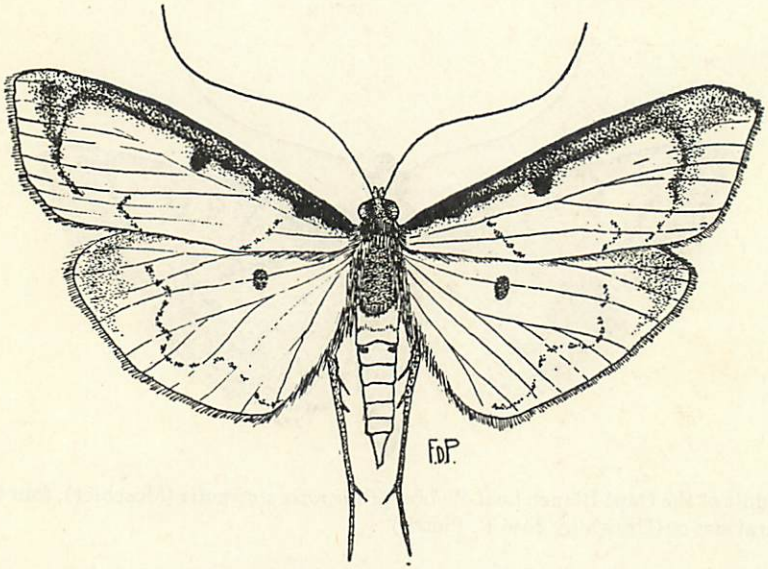
Adult of the Capá Blanco Leaf-Webber, *Pilocrocis secernalis* (Möschler), four times natural size. (Drawn by José F. Pietri.)

It is an inconspicuous little brownish moth with three darker bands on the fore wing, of which Dr. Luis F. Martorell reared numerous adults, as identified by Mr. Carl Heinrich, from caterpillars defoliating trees of "capá blanco" (*Petitia domingensis*) in November and December 1940 at Aguas Buenas and San Sebastián.

Pilocrocis tripunctata (Fabricius) was listed from Puerto Rico by all the early entomologists as *Acrospila campalis* Guenée. Mr. Thos. H. Jones (1915-9) found "sweet potato leaves webbed together and injured by the larva" and illustrated the adult. Mr. E. G. Smyth found larvae on what was at that time identified as *Ipomoea bonanox*: "bejuco de vaca" (*Calonyction aculeatum*). Adults have been repeatedly taken at light at Bayamón, and Dr. Schaus (1940-343) records collections at Coamo and Guayama. The adult is a yellowish moth with a wing expanse of 25 mm., a prominent brown spot near the costal margin of the hind wing, another less well

marked at the apex. The forewing has several brown spots along the costal margin, of varying size and intensity.

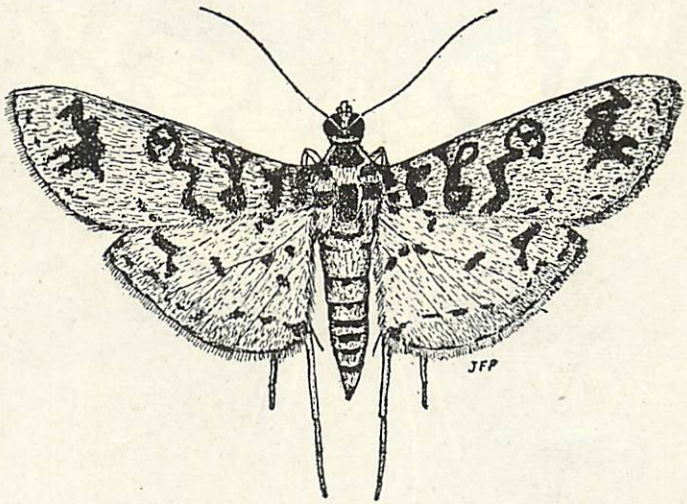
Mesocondyla concordalis (Hübner), most recently re-placed in the genus **Eulepte,** in which it was originally described, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as an *Acrospila,* and as *Acrospila gastralis* Guenée, with no note as to the host plant of the larva. The injury to the foliage of the calabash tree or "higüero" (*Crescentia cujete*) is often conspicuous, but the caterpillars may also attack that of the "roble"



Adult of the Roble Leaf-Webber, *Eulepte concordalis* Hübner, three times natural size. (Drawn by Francisco D. Palacios Comelin.)

(*Tecoma pentaphylla* or *Tabebuia pallida*), the "roble de sierra" (*Tabebuia rigida* and *T. argentea*), the "higüerillo" (*Enallagma latifolia*), as well as of one tree not present in Puerto Rico at the time of Gundlach's visits: the imported African tulip tree or "tulipán" (*Spathodea campanulata*). All of these trees belong to the family of the Bignoniaceas, the caterpillars by their choice of food plants, or the female moths by their selection of trees on which to oviposit, confirming the opinion of the botanists as to their essential similarity. Mr. E. G. Smyth collected at light at Hda. Santa Rita, Guánica, during the latter half of 1913, eighteen of these "fancy yellow Pyralids," and they are often quite common at light in the mountains or in the more humid parts of the Island. Dr. Schaus (1940-344) notes collection at Lares and on El Yunque, as well as on Vieques Island.

Prof. J. A. Ramos (1947-49) collected "numerous adults of the pale variety (det. W. T. M. Forbes), Sardinera Beach" on Mona Island, confirming the observation of Dr. Luis F. Martorell, who had noted the larvae attacking the leaves of *Tabebuia heterophylla* and *T. lucida* on the plateau of Mona. The costal margin of the fore wing of these pale iridescent yellow moths is brown, broadening towards the apex and extending down on the outer margin; the hind wing has prominent (or sometimes only traces of) two brown spots. The caterpillars are attacked by the Tachinid fly, *Sturmia albincisa* (Wiedemann), by the Chalcid wasp, *Bracymeria incerta* (Cresson). Dr. Luis F. Martorell, in his "Notes on the Biology of *Mesocondyla concordalis* Hübner, and its Parasites" (Caribbean Forester, **2** (1): 18–19,



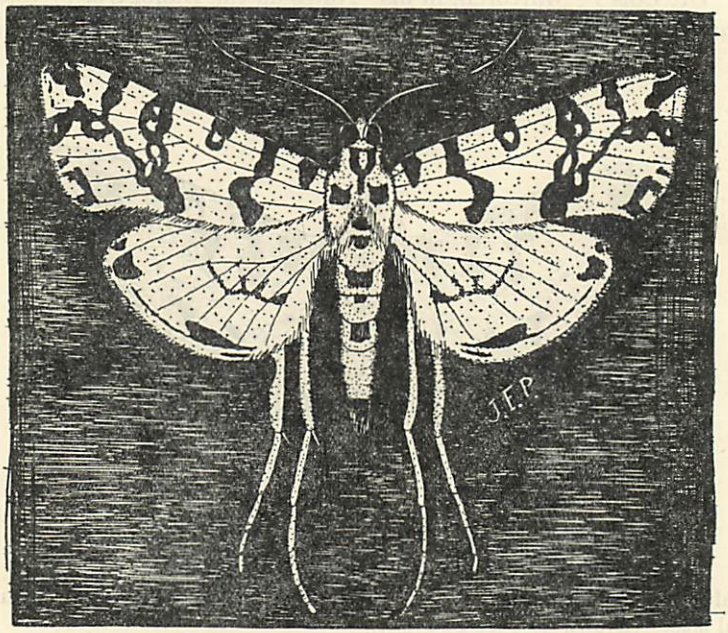
Adult of the Colubrina Leaf-Roller, *Spilomela fimbriauralis* (Guenée), about twice natural size. (Drawn by José F. Pietri.)

fig. 1. New Orleans, October 1940), records rearing another Braconid wasp, *Microbracon cushmani* Muesebeck, from larvae collected several times on the southeastern coast of Puerto Rico (at Naguabo and Maunabo), and on Mona Island. Prof. Forbes has separated males, larger and with squarer looking wings, from Lares, Cayey and El Yunque under the name *gastralis* Guenée, but wonders if there is any biological basis for such division.

Spilomela fimbriauralis (Guenée) is recorded from Puerto Rico by Dr. Schaus (1940–344): a specimen from Aibonito. Dr. Luis F. Martorell found numerous larvae rolling the leaves of "abeyuelo" (*Colubrina ferruginosa*) at Guajataca Gorge, Quebradillas, in November 1940, and at San Sebastián in December of the same year, being most abundant on trees

in the shade, those in the open not being attacked. The beautiful yellow adults with brown and golden spots were determined as this species by Mr. Carl Heinrich.

Conchylodes diphteralis (Geyer) is listed from Puerto Rico as a *Ledereria* by all the early entomologists, Dr. Gundlach noting "la oruga en especies de *Cordia*, y la crisálida en su capullo, hace saltar este a distancia de algunas pulgadas." This is a conspicuous silvery white moth, its fore wings with circles or bars of black, of which Dr. Luis F. Martorell reared several from gregarious caterpillars webbing together leaves of "capá prieto"

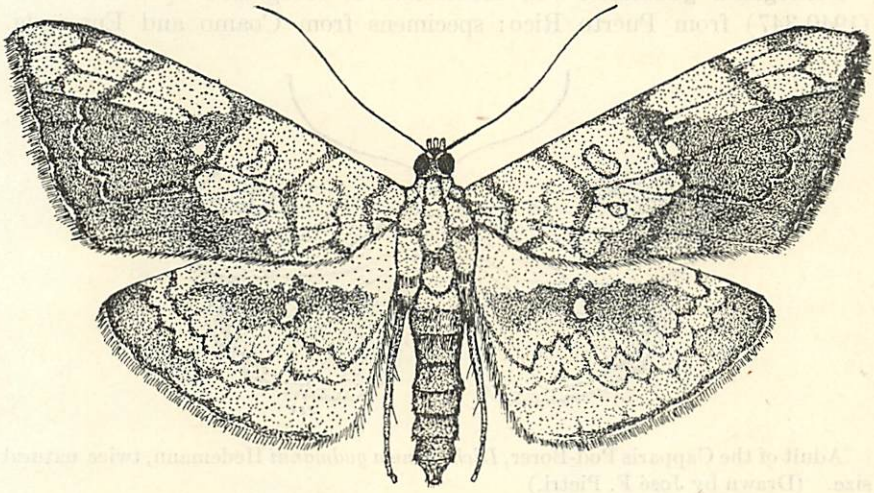


Adult of the Capá Prieto Leaf-Webber, *Conchylodes diphteralis* (Geyer), three times natural size. (Drawn by José F. Pietri.)

(*Cerdana alliodora*) at Cayey in October 1940. They were identified by Mr. Carl Heinrich. Dr. Schaus (1940-345) records collection of adults at Lares, and gives as the distribution of this species, Cuba, Jamaica and Haiti. Dr. Harrison G. Dyar identified as *Concylodes hebraealis* Guenée specimens from Haina, Dominican Republic.

Pantographa limata Grote & Robinson, as identified by Mr. Carl Heinrich, was reared by Dr. Luis F. Martorell from larvae cutting and rolling the leaves of "guano" (*Ochroma pyramidale*) on El Yunque in September 1940. It has been noted repeatedly there, and less often elsewhere, subsequently, but we have no way of determining if it was present in Puerto

Rico previous to that date. Some of the larvae were parasitized by *Chelonus insularis* Cresson. Dr. W. J. Holland in "The Moth Book," on page 393, claims that "the insect occurs from Maine to Patagonia." The U. S. National Museum has no specimens from farther south than Río de Janeiro, Brasil, and none of the South American material was reared. Prof. John Henry Comstock, in discussing the basswood leaf roller, says that "our bass-wood trees often present a strange appearance from the fact that nearly every leaf is cut more than half way across the middle, and the end rolled into a tube. Within this tube there lives a bright green larva, with the head and thoracic shield black. The moth expands about one and one half inches; it is straw-colored, with many



Adult of the Guano and Basswood Leaf-Roller, *Pantographa limata* Grote & Robinson, three times natural size. (Drawn by José F. Pietri.)

elaborate markings of olive with purplish iridescence." The attack on balsa leaves in Puerto Rico is identical with that on basswood in the States, altho the two hosts are not botanically but only superficially similar in having very large leaves.

Dichogama amabilis, described by Herr Heinrich B. Möschler (1890-296) from a pair in the Krug collection from Puerto Rico, was listed by Dr. Gundlach. It has not since been found in Puerto Rico, but Dr. Luis F. Martorell collected numerous specimens at Camp Kofresí, Mona Island in 1939, and Prof. J. A. Ramos (1947-49) made additional collections at the same locality. The silvery white moth has a wing expanse of 35 mm., the fore wing creamy with a small orange spot and black dot at the apex.

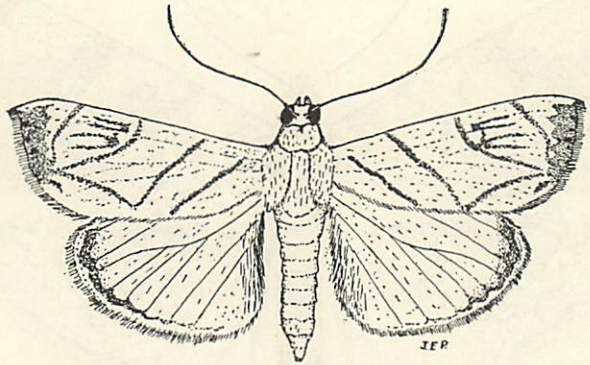
Dichogama bergii was described by Herr Heinrich B. Möschler (1890-

297) from a single female collected by Dr. Gundlach in Puerto Rico. It has not since been found locally.

Dichogama colotha Dyar, originally described from Mexico, is recognized by Dr. Schaus (1940-345): males from Coamo.

Dichogama fernaldi was described by Herr Heinrich B. Möschler (1890-279) from Puerto Rico, and is listed by Dr. Gundlach. Dr. Schaus (1940-346) identifies this species from Vieques Island, and Prof. J. A. Ramos (1947-49) collected a single adult, identified by Prof. Wm. T. M. Forbes, on Mona Island. Adults doubtfully identified as this species by Mr. Carl Heinrich were reared by Dr. Luis F. Martorell from larvae on leaves of "palinguán" (*Capparis flexuosa*) at Salinas in the summer of 1940.

Dichogama gudmanni von Hedemann is recognized by Dr. Schaus (1940-347) from Puerto Rico: specimens from Coamo and Ensenada.



Adult of the Capparis Pod-Borer, *Dichogamma gudmanni* Hedemann, twice natural size. (Drawn by José F. Pietri.)

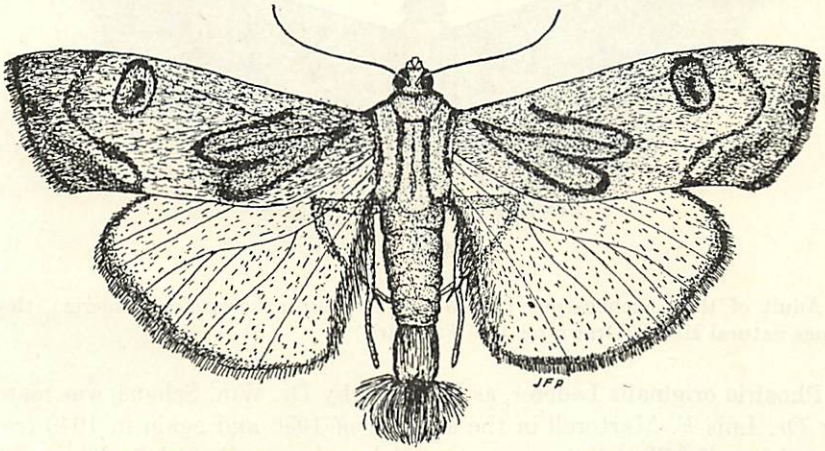
Dr. Luis F. Martorell reared these silvery white adults, as determined by Mr. Carl Heinrich, from larvae folding leaves and burrowing in pods of "burro prieto" (*Capparis cynophallophora*) at Salinas in the summer of 1940. Their fore wings are margined in yellow, and bear a more, or usually less, apparent pattern of fine dark lines.

Dichogama innocua (Fabricius) was re-described and illustrated by Herr Heinrich B. Möschler (1890-296) as *D. krugii* from Puerto Rican material of which Dr. Gundlach had five specimens of both sexes. Dr. Schaus (1940-346) recognizes as this species specimens from Coamo. Judging by Möschler's illustration, it is only a more distinctly patterned *gudmanni*.

Dichogamma jessicales is described by Dr. Wm. Schaus (1940-346) from a male with a wing expanse of 25 mm., from Coamo, mostly white, its fore wings "finely irrorated with pale smoke grey and suffused with light drab."

Dichogama redtenbacheri Lederer was listed from Puerto Rico by Herr

Möschler, and Dr. Gundlach notes "también en Cuba, Santo Tomás, Santa Cruz." Dr. Schaus (1940-346) lists it from Coamo and the Island of Vieques, and numerous adults have been taken at light on Mona Island, as noted by Prof. J. A. Ramos (1947-49). Mr. E. G. Smyth collected three adults at light at Hda. Santa Rita, Guánica, during the latter half of 1913, identified by Dr. Harrison G. Dyar. Dr. Luis F. Martorell noted heavy infestations of caterpillars feeding on the foliage of "palinguán" or "palo de burro" (*Capparis flexuosa*) at Salinas, Santa Isabel, Yauco, Guánica and Arecibo during the summer of 1940, and reared adults which were identified by Mr. Carl Heinrich. Some are a satiny and semitransparent brownish yellow, with but the faintest indication of a pattern on the



Adult of the Capparis Leaf-Webber, *Dichogamma redtenbacheri* Lederer, three times natural size. (Drawn by José F. Pietri.)

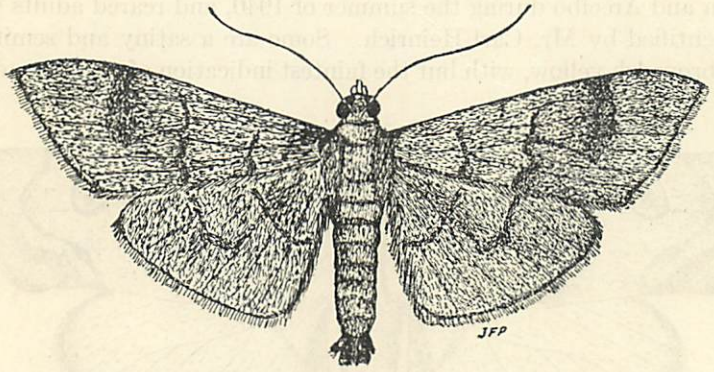
fore wing; others have very conspicuous markings in dark brown, or but slightly darker oval or irregular areas with dark brown margins.

Phostria humeralis (Guenée), listed from Puerto Rico as an *Omoides* by Herr Möschler and Dr. Gundlach, was recently collected at light at Utuado by Dr. W. A. Hoffman, and Dr. Schaus (1940-347) lists collection at Lares. From green caterpillars feeding on the foliage of "guaba" (*Inga vera*) at Cayey in December 1940, Dr. Luis F. Martorell reared adults which were determined as being this species by Mr. Carl Heinrich. With a wing spread of 32 mm., these almost plain, dull, dark brown moths have shoulder lappets or patagia extending as far back as the anal angle of the hind wings.

Phostria insolutalis was described by Herr Heinrich B. Möschler (1890-301), but Dr. Gundlach states that he "no indica si hay seguridad de su existencia en Puerto Rico," and no collection has since been made locally.

Phostria martyralis (Lederer) was listed from Puerto Rico as a *Coenos-*

tola by Herr Möschler and Dr. Gundlach, the latter noting its abundance in Cuba. During the winter of 1940–41, Dr. Luis F. Martorell found greenish caterpillars webbing together leaves of "genogeno" (*Lonchocarpus domingensis*) at Guayanilla and of "palo hediondo" (*Lonchocarpus latifolius*) at Maunabo, which he reared to adult. These were identified by Mr. Carl Heinrich: orange-brown moths with three narrow darker bands on the fore wings and two on the hind wings.



Adult of the Lonchocarpus Leaf-Webber, *Phostria martyralis* (Lederer), three times natural size. (Drawn by José F. Pietri.)

Phostria originalis Lederer, as identified by Dr. Wm. Schaus, was reared by Dr. Luis F. Martorell in the summer of 1936 and again in 1940 from greenish caterpillars living congregated in a dense web and feeding on the foliage of "moca" (*Andira jamaicensis*) at Barranquitas, Aibonito and Cayey. The adult is a light yellowish-brown moth with the standard three narrow wavy darker bands on the fore wings and two on the hind wings. Mr. Hahn W. Capps states that the name *martyralis*, for an East Indian species, is incorrect for the Puerto Rican insect.

Phostria prolongalis (Guenée), listed from Puerto Rico as a *Microthyris* by Herr Möschler and Dr. Gundlach, is confirmed by a subsequent collection at Aibonito recorded by Dr. Schaus (1940-347).

Phostria simialis (Guenée), listed from Puerto Rico as *Coenostola eruptalis* Lederer by Herr Möschler and Dr. Gundlach, has been intercepted at light at Bayamón.

Blepharomastix acutangulalis (Snellen) is identified as a *Bocchoris* by Dr. Schaus (1940–342): specimens from Coame and San Germán.

Blepharomastix ebulealis (Guenée) is identified by Dr. Schaus (1940–350), specimens from Lares and El Yunque. Dr. Luis F. Martorell found larvae of this species acting as leaf-folders on a "camasey" (*Heterotrichum cymosum*), some of which were parasitized by the Tachinid fly *Leskiopalpus*

flavipennis (Wiedemann). Those reared to adults, as determined by Mr. Carl Heinrich, had a wing spread of 15 mm., were golden yellow in color, their wings with transverse brown lines.

Blepharomastix stenialis (Guenée), as determined by Mr. Carl Heinrich, was collected by Dr. W. A. Hoffman at El Semil, Villalba, May 10, 1940. Prof. Forbes notes an additional collection at Cayey by Mr. Huntoon of this moth which occurs thruout the neotropics from Argentina to Massachusetts. By other workers it is called a *Lamprosema* or a *Nacoleia.*

Lamprosema inabsconsalis was described as a *Diasemia* by Herr Heinrich B. Möschler (1890-306) from both sexes collected in Puerto Rico by Dr. Gundlach, and listed by him. More recent collections listed by Dr. Schaus (1940-350) are from Lares, Coamo and Aguirre, and from Vieques Island. Prof. J. A. Ramos (1947-50) found a single specimen at light on Mona Island.

Lamprosema iarchisalis (Walker) is identified by Dr. Schaus (1940-349) from Puerto Rico: specimens from Lares, Coamo, Aguirre and Palmas Abajo (between Guayama and Jájome Alto).

Lamprosema memoralis was described by Dr. Wm. Schaus (1940-348), the type from Coamo, wing expanse 14 mm., "head and thorax brownish drab"; "wings grayish drab." It was this species which was cited by Herr Möschler and Dr. Gundlach as *Lamprosema lunulalis* Hübner from Surinam, from which it differs in size and markings.

The Cornell University collection contains a single specimen labeled "*Lamprosema santialis* Schaus", very close to the continental *pelealis* Walker, according to Prof. Forbes, which was collected at Coamo Springs. Apparently Dr. Schaus did not publish a description, and this is a MS name.

Lamprosema subulalis (Guenée) was re-described and illustrated from Puerto Rico by Herr Möschler and listed by Dr. Gundlach under the name of *Sisyracera preciosalis*, also from Surinam. Dr. Schaus (1940-348) records occurrence in Guatemala, and in Puerto Rico.

Lamprosema xanthialis (Guenée) was listed from Puerto Rico as *Botys incalis* Snellen, of which Herr Heinrich B. Möschler (1890-285) described the variety *rosealis*, "not separable," according to Dr. Schaus (1940-350). Adults of this moth, which is common in Hispaniola and Cuba, have repeatedly been intercepted at Bayamón.

Lamprosema zoilusalis (Walker) was re-described from Jamaica by Herr Heinrich B. Möschler and listed by him and Dr. Gundlach from Puerto Rico under the name *Botys hilaralis.* It has been intercepted at light at Bayamón and Mayaguez, and Dr. Hoffman collected it at Utuado. Dr. Schaus (1940-349) lists additional collections at Lares, Aibonito, Coamo, Manatí and San Germán.

Hedylepta indicata (Fabricius) was listed from Puerto Rico by all the early entomologists as *Hedylepta vulgalis* (Guenée) and according to Dr. Schaus (1940-349) also re-described by Herr Möschler (1890-288) as *Botys fortificalis*. Dr. Gundlach gives both names, noting of the former "la oruga se cría entre las hojas reunidas de plantas de la familia de las papilionáceas." Mr. H. K. Plank uses the generic name *Hedyleptz* (1945-26) in discussing these caterpillars as a pest of soybeans, from which he reared three parasites, but Mr. Thos. H. Jones (1915-9) uses *Nacoleia* in noting their attack on the leaves of beans and cowpeas, as does Dr. Richard T. Cotton (1918-278), giving as a common name the "bean leaf-webber." He continues: "The small, dirty-green colored larva webs the leaves (of bean) together, living between them and skeletonizing them with its feeding." The little dull golden-brown moths are common at light in all the more humid parts of the Island, as well as on Vieques. The adult reared by Mr. E. G. Smyth from a larva on *Lantana camara* is not this species, being much more yellow, the transverse brown lines on the forewings being narrow and regular, not broad and broken. Those he reared from caterpillars on "zarzabacoa" (*Meibomia purpurea*) in the summer of 1916, are typical however, and since the introduction of derris into Puerto Rico, its leaves have repeatedly been observed attacked, first at Río Piedras and subsequently at Mayagüez. In the Mayagüez Station Report for 1938 (1939-108) their parasitism by *Chrysocharis* sp. and *Apanteles* sp. is noted. The common parasite, attacking other Pyralid leaf-webbers as well, is the Tachinid fly, *Sturmia* (or *Argyrophylax*) *albincisa* (Wiedemann). Despite heavy parasitism the caterpillars are often of sufficient abundance on garden beans and lima beans to require control by means of insecticides, calcium arsenate being the standard remedy until DDT and others of the newer chemicals were commercially available.

Sylepta ceresalis (Walker) was re-described from Puerto Rico by Herr Heinrich B. Möschler (1890-314) as *Diaphantania conspicualis* from three females which Dr. Gundlach had collected. Dr. Schaus (1940-352) lists a more recent collection from Coamo, and Prof. Forbes found it on Vieques Island.

Sylepta denticulinea was described by Dr. Wm. Schaus (1940-351) from a single badly rubbed female, intercepted at light at Bayamón, which has a wing expanse of 25 mm., mostly light buff in color, "but easily recognized by the outer line."

Sylepta elevata (Fabricius) was listed as a *Botys* from Puerto Rico by Herr Möschler and Dr. Gundlach. Mr. E. G. Smyth collected only six of these "speckled yellow Pyralids" at light at Hda. Santa Rita, Guánica during the latter half of 1913, as determined by Dr. Harrison G. Dyar, and only one at Río Piedras. It has been intercepted at light at Bayamón,

and Dr. Schaus (1940-353) notes additional collections at Mayagüez and San Germán. Mr. E. Molinary Salés found larvae in the tubers of sweet potatoes, in stems, and even eating into wooden stakes at the surface of the ground of experimental plots, late in 1947, from which many adults were reared. The moths have black eyes, but otherwise are a dull, light yellow, with dark pink spots on body, abdomen and wings; the fore wing sometimes having as many as thirty spots on it, quite evenly distributed from base to outer margin. This is the first recorded instance of this insect being a pest in Puerto Rico, and indeed, up to the time of Mr. Molinary's collection nothing was known locally as to the host plant of the larva. Dr. Gundlach gives the distribution of the insect as Belém do Pará, the Guianas and Cuba, and in the "Catálogo de los Insectos que Atacan a las Plantas Económicas de Cuba" (Boletín No. 63, Estación Experimental Agronómica, pp. 246, pl. 12. Santiago de las Vegas, September 1945) Messrs. S. C. Bruner, L. C. Scaramuzza and A. R. Otero record its interception in sweet potatoes at Santiago de las Vegas in abundance in August 1930. "Las larvas, aparentemente, se alimentan de los tejidos exteriores. No se ha observado en boniatos en otra ocasión, y su *status* como plaga es dudoso."

Sylepta gordialis (Guenée) was listed from Puerto Rico by all the early entomologists as an *Asciodes*, and Dr. Gundlach and Herr Möschler also give the name *Asciodes scopulalis* Guenée in doubtful synonymy. The caterpillars web together the leaves of the Bougainvillea vine, and have been reared to adult, as determined by Dr. Harrison G. Dyar, at Río Piedras, at Pt. Cangrejos and at Isabela. They have also been intercepted eating the leaves of four o'clock at San Juan, and adults have been repeatedly intercepted at light at Bayamón. Dr. Schaus (1940-351) lists additional collections at Coamo, Lares and San Germán, as well as on Vieques, and presumably the insect occurs wherever its host is planted. The moth is singularly uninteresting; dull grey in color, forewings barred and the hind wings margined with darker grey. If handpicking does not control the caterpillars, one might try, with caution, spraying with a water-suspension of DDT.

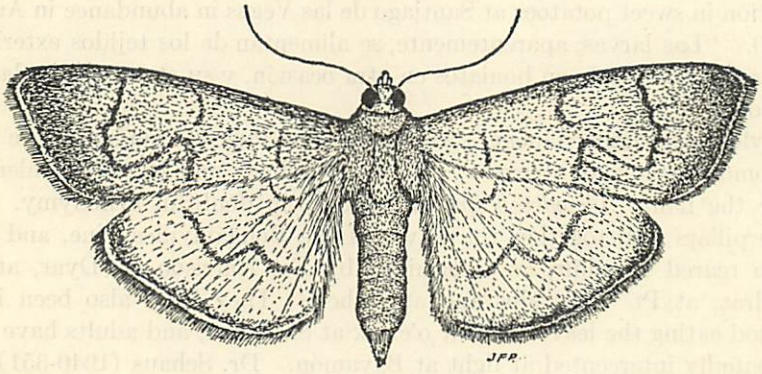
Sylepta helcitalis (Walker) was re-described by Herr Heinrich B. Möschler (1890-308) from three males collected by Dr. Gundlach in Puerto Rico under the name of *Crossophora miscellalis*. Dr. Schaus (1940-351) records collection of adults at Lares and on El Yunque. Under this name, Mr. Charles E. Wilson, writing of the "Truck-Crop Insect Pests in the Virgin Islands and Methods of Combating Them" (Bulletin No. 4, Virgin Islands Agr. Expt. Station, pp. 35, fig. 24. Washington, D. C., 1923), describes a sweet potato leaf-folder, apparently of considerable importance, parasitized by a Tachinid fly (*Exorista pyste*). This name is not listed by

Mr. Harry A. Beatty in his "Fauna of St. Croix" (Jour. Agr. Univ. P. R., **28** (3–4) : 103–185). Río Piedras, July–October 1944), altho he had access to all the insect determinations of the Experiment Station.

Sylepta internitalis (Guenée) was listed from Puerto Rico by all the early entomologists as *Sathria stercoralis* Lederer. Dr. Schaus (1940-352) notes a more recent collection at Coamo.

Sylepta onophasalis (Walker) is listed from Puerto Rico by Dr. Schaus (1940-252): collections from Coamo, Aibonito and from Vieques Island.

Sylepta patagialis (Zeller) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name of *Herpetogramma servalis* Lederer. Dr. Gundlach had three females, but Dr. Schaus (1940-351) is of the opinion that "there is a misidentification." Dr. W. A. Hoffman collected females at El Semil, Villalba, May 10, 1941, concerning which Mr. Carl Heinrich noted "must have males for exact determination."



Adult of the Yagrumo and Ortiga Leaf-Roller, *Sylepta silicalis* (Guenée), three times natural size. (Drawn by José F. Pietri.)

Sylepta silicalis (Guenée), as determined by Dr. Harrison G. Dyar, is a rich, cream-colored moth, with very faint pinkish transverse lines on its wings, of which larvae have been found feeding on the leaves of "yagrumo" (*Cecropia peltata*) at Lares and on El Yunque, especially singling out the more tender leaves and the bud for consumption. Dr. Luis F. Martorell found similar larvae feeding on the leaves of *Urera chlorocarpa* at Jayuya, from which a single adult reared appeared to be this species. Mr. H. W. Capps identified a single adult reared from a large number of larvae which had half defoliated a clump of the nettle "ortiga" (*Urera baccifera*) at La Romana, Dominican Republic, as being this species, confirming the selection for consumption by these larvae of plants which seem most unlike, but botanically are in adjoining families.

Lygropia imparalis (Walker) is identified as *L. flavofuscalis* (Snellen)

by Dr. Schaus (1940-353) specimens from Cataño, Aguas Claras (between Fajardo and Naguabo), Aguirre and from the Island of Vieques.

Lygropia joelalis was described by Dr. Wm. Schaus (1940-354) from a female collected on Vieques Island by Prof. Wm. T. M. Forbes, "allied to *L. flavofuscalis* (Snellen)," which has a wing expanse of 12 mm., "palpi isabella color," "head, collar and thorax very light brownish olive;" "wings above very light brownish drab." Prof. Forbes thinks it merely a variety of *flavofuscalis* which has lost all the yellow marks except the basal one, for he caught several normal *flavofuscalis* with the type.

Lygropia joasharia was described by Dr. Wm. Schaus (1940-353) from a female, collected on Vieques Island by Prof. Wm. T. M. Forbes, which has a wing expanse of 17 mm., "head, collar and thorax pinkish cinnamon; fore wing pale yellow orange," "easily recognized by the distinct line on discocellular."

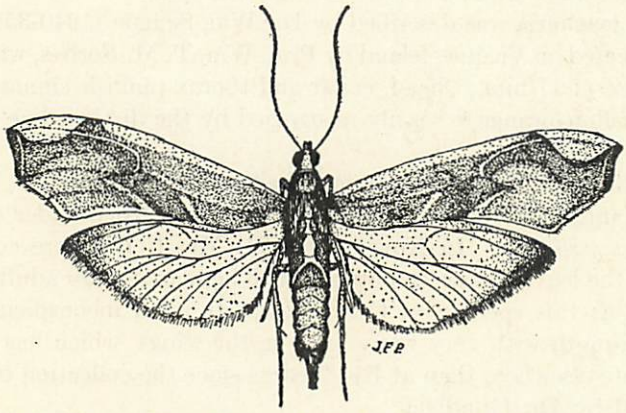
Lygropia lelex (Cramer) was re-described by Herr Heinrich B. Möschler (1890-309) and listed by Dr. Gundlach from Puerto Rico under the name of *Cyclocena gestatalis*. In November 1921, Mr. J. D. More collected a leaf-tier on the leaves of sweet potato which he reared to an adult that was determined as this species by Dr. Schaus. It is an inconspicuous little light brown moth with very wavy lines on the wings, which has not been found to date elsewhere than at Río Piedras since the collection of the two males noted by Dr. Gundlach.

Lygropia placendalis was described as a *Botys* by Herr Heinrich B. Möschler (1890-285) and thus listed by Dr. Gundlach from a single female which he had collected in Puerto Rico. It has not since been found locally.

Lygropia principaloides was described as a *Botys* by Herr Heinrich B. Möschler (1890-295), and thus listed by Dr. Gundlach from a single male which he had collected in Puerto Rico. It has not since been found locally.

Agathodes designalis Guenée was listed from Puerto Rico as a *Stenurges* by Herr Möschler and Dr. Gundlach, the former noting "Raupe nach Berg auf Erythrina cristigalli, nach Guenée an Asclepias incarnata, nach Le Conte an Salix." According to observations in Puerto Rico, various species of *Erythrina* are most often selected for hosts, the caterpillars not only rolling leaves, but also boring in tender watershoots, and sometimes even in the bark of large trees, noted at Río Piedras, Cayey, Aibonito, Villalba and Arecibo. Indeed, this might well be called the Erythrina or bucare stem borer, altho Dr. Richard T. Cotton in January 1917 found numerous yellow larvae spotted with black on a tree near Río Piedras identified by Mr. J. A. Stevenson as *Citharexylum fruticosum*, the common "péndula." Adults have been collected at light at Villalba, Mayagüez, and Añasco, and presumably the insect occurs in all the mountainous and humid sections of the Island. The moth in colors is a symphony in gold

and lavender, but rests in a most ungainly position with the end of its abdomen straight up. Its narrow, angled and cleft forewings are dull gold, with a median parallelogram of lavender laterally bordered with iridescent silver, the same colors appearing on its body. The moths are sometimes common at light, reflecting a comparable abundance of the caterpillars, especially in nurseries of young trees. Earwigs, several kinds of ants, and numerous other insects may subsequently occupy their tunnels after the emergence of the adults.



Adult of the Bucare Stem-Borer, *Agathodes designalis* Guenée, two and a half times natural size. (Drawn by José F. Pietri.)

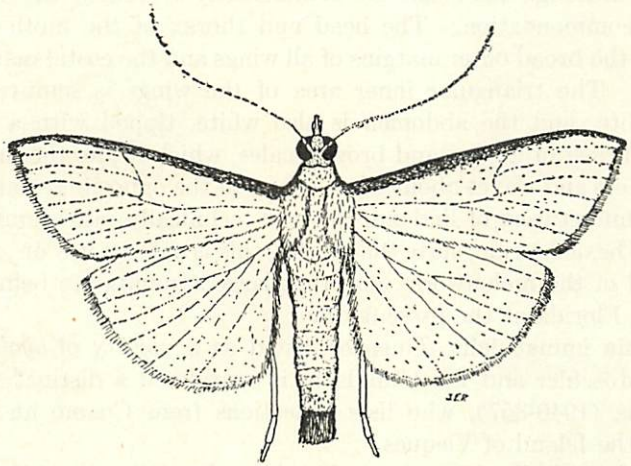
Diaphania ausonia (Cramer) was listed as a *Hoterodes* by all the early entomologists from Puerto Rico, but it has not since been found locally.

Diaphania (or **Margaronia**) **costata** (Fabricius) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name of *Pachyarches aurocostalis* Guenée: a singularly appropriate name for an all silvery white moth except for the costal margin of the forewings, which is golden. Mr. E. G. Smyth took ten of these "bluish-white Pyralids" at light at Hda. Santa Rita, Guánica during the latter half of 1913, and Dr. Schaus (1940-356) lists collections at Coamo, San Germán and from Vieques Island. Prof. J. A. Ramos (1947-50) collected adults at light on Mona Island, and noted the larvae on their host plant, "palo de muñeca" (*Rauwolfia nitida*). Each larva makes a very neat bag of one or two leaves, within which it lives and eventually within which it pupates, such characteristic bags having first been noted at Camuy, and subsequently at Guajataca and Guayama. Mr. Francisco Seín found several larvae rolling the leaves of a climbing bean at Boquerón in January 1923, which, when reared to adult, proved to be this species.

Diaphania flegia (Cramer) is a considerably larger moth than *D.*

costalis, and the costal margin of its forewings is brown, not golden. Mr. J. A. Stevenson brought in larvae from Isabela Grove, Plantaje, Pt. Salinas, in July 1916, which he found eating the leaves and webbing together the foliage of the "cabalonga" or "cabalón," the lucky nut tree (*Cerbera* or *Thevetia thevetia*), and in April 1937, Dr. Mel. T. Cook found them on the same host at La Fortaleza, San Juan. Twice collected by Plant Pathologists, the third record on the same host at Isabela was by Mr. Francisco Seín, in July 1933, and later at Lares.

Diaphania elegans was described as a *Phacellura* by Herr Heinrich B. Möschler (1890-299) and thus listed by Dr. Gundlach from several specimens from Puerto Rico. It has been intercepted on medicinal herbs at



Adult of the Rauwolfia Leaf-Folder, *Diaphania* (or *Margaronia*) *costata* (F.), three times natural size. (Drawn by José F. Pietri.)

San Juan, as identified by Mr. Carl Heinrich, and Dr. Schaus (1940-356) records collections from El Yunque, and from St. Croix and St. John of the Virgin Islands, under the name *Margaronia*, as of all others of the genus.

Diaphania fuscicaudalis (Möschler), originally described from Jamaica and Surinam, is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but it has not since been found in the West Indies, according to Dr. Schaus (1940-357).

Diaphania hyalinata (Linnaeus) is listed from Puerto Rico by Dr. Stahl as *Phacellura immaculalis* Guenée, and by Herr Möschler and Dr. Gundlach with the latter name as a variety, the latter quoting the former that "la oruga se cría en curcubitaceas y también en *Ipomoea*." Both are quite correct as to the cucurbitaceous hosts, for caterpillars have repeatedly been found on cucumber, cantaloupe, watermelon, cassava melon, pump-

kin, squash and cocozelle squash, and even on yautía, but not on sweet potatoes or any wild species of *Ipomoea*. This is the "melonworm" of the United States, listed as a *Diaphania* by Mr. O. W. Barrett (1903-448), Mr. Thos. H. Jones (1916-8), Dr. R. T. Cotton (1918-294) and in Van Zwaluwenburg's list (920): on Cucurbitaceae. The longitudinally-striped caterpillars feed on the more tender leaves, on the flowers, and even on the developing young fruits of many of these plants. By adding arsenate of lead to the Bordeaux mixture that must be used to obtain a commercial crop, control of the melonworm has been obtained in the past. Because DDT prevents fruiting of cucumbers, it can not be used for the control of this caterpillar, and the use of others of newer insecticides is indicated, although none has been sufficiently tested in the tropics for specific recommendation. The head and thorax of the moth is brown, as are also the broad outer margins of all wings and the costal margin of the fore wing. The triangular inner area of the wings is semi-transparent silvery white, and the abdomen is also white, tipped with a relatively enormous brush of golden and brown scales, which in life the moth opens and contracts and waves about when others of the opposite sex are present.

The manufacturers of lindane, the new technically pure gamma isomer of benzene hexachloride, state that at 1% this is safe to use on cucumbers for control of the melonworm, and that large amounts are being used by growers in Florida at the present time.

Diaphania immaculalis (Guenée), listed as a variety of *hyalinata* (L.) by Herr Möschler and Dr. Gundlach, is considered a distinct species by Dr. Schaus (1940-357), who lists collections from Coamo and Arecibo, and from the Island of Vieques.

Diaphania imitalis (Guenée) is listed by Dr. Schaus (1940-357) from Puerto Rico: specimens from Coamo, for he considers it "a distinct species, and not a synonym of *M. aurocostalis* (Guenée) as stated by Hampson."

Diaphania infernalis, as a *Phacellura* is described by Herr Heinrich B. Möschler (1890-300) as "am nächsten bei *Nitidalis* stehend," and is listed by Dr. Gundlach from Puerto Rico. Adults determined by Mr. Carl Heinrich were collected by Dr. W. A. Hoffman at El Semil, Villalba on May 10, 1941, and Mr. Francisco Seín found it at Lares.

Diaphania infimalis (Guenée) is listed by Dr. Schaus (1940-356) from Puerto Rico: a specimen from Mayagüez.

Diaphania isoscelalis (Guenée) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Diaphania lucidalis (Hübner) is listed from Puerto Rico by all the early entomologists as a *Phacellura*, and Dr. Schaus (1940-357) lists a subsequent collection at Santurce.

Diaphania nitidalis (Cramer) is listed by Dr. Stahl as *Phacellura hyalinasalis*, and by Herr Möschler and Dr. Gundlach as a *Phacellura*. Mr. Francisco Seín, writing on "The Pickle Worm in Chayote in Porto Rico" (Jour. Ec. Ent., **24**(3): 762. Geneva, June 1921), reports finding 20 per cent of the "chayote" (*Sechium edule*) fruits infested with these caterpillars at Lares and five to ten per cent at Río Piedras. It also infests the fruit of cucumbers, interceptions having been made at Loíza Aldea, Vega Baja, Manatí and Isabela, and is not subject to insecticidal control for it burrows within the fruit. The adult is a golden brown moth, the base of the hind wings and a smaller irregular-shaped area in the forewings being semi-transparent golden yellow. It is rarely taken at light, altho Dr. W. A. Hoffman made collections at El Semil, Villalba. Apparently the insect is more common in the mountains than at lower elevations, and is not found at all in xerophytic regions.

Diaphania sibillalis (Walker) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Glyphodes*. It is a beautiful golden brown and white moth, its fore wings having three larger irregular white areas partly iridescent golden, separated by dark brown margined light brown areas, and a narrow, irregular, submarginal white band that continues on the hind wings. The moths which Mr. Francisco Seín reared from caterpillars which he found during the winter of 1922 feeding on the leaves of mulberry (*Morus alba*, var. *tartarica*) are somewhat different, however, having in addition on the hind wings an irregular brown band surrounding the central iridescent golden area, and submarginally more brown. Adults have repeatedly been intercepted at light at Bayamón, and Dr. Schaus (1940-358) reports additional collections at San Juan, Aguirre, Coamo, and Guánica, as well as on Vieques Island.

Palpita quadristigmalis (Guenée) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as a *Margarodes*, and it has since been collected at light at Guánica and intercepted at Bayamón. Dr. Schaus (1940–358) notes additional collections on El Yunque and on Vieques Island. It has semi-transparent, whitish wings, the costal margin brown, with four small black spots or points as indicated by the name; and in addition two near the apex and one in the middle of the hind wing.

Cliniodes euphrosinalis Möschler, originally described from Jamaica, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach: a single well preserved specimen in the Krug collection. It has not since been found locally. *Cliniodes* sp. "near *nomadalis* Dyar" was the determination by Mr. Carl Heinrich of a large moth with semi-transparent silvery wings, narrow lines of black on the outer margin of the hind wing, brownish at base of forewing and scatteringly elsewhere, which Dr. W. A. Hoffman had taken at light at El Semil, Villalba on May 10, 1940.

Cliniodes semilunalis was described by Herr Heinrich B. Möschler from several females in the Staudinger collection from Puerto Rico (1890-297), and is listed by Dr. Gundlach. It has not since been found locally.

Syllepsis marialis Poey, originally described from Cuba, was recognized by Herr Möschler in the Krug collection from Puerto Rico, and is listed by Dr. Gundlach. Dr. Schaus (1940-359) notes collections from Aibonito and Coamo. Dr. Luis F. Martorell found numerous small green larvae rolling the leaves of "quebracho" (*Thyana portoricensis*) at Guayanilla, especially in the most shady locations, in January 1941, from which he reared adults which were determined as being this species by Mr. Hahn W. Capps. The body of this slender moth is purplish brown, as are also broadly the apical angles of both wings and the base and hind angle of the forewing; elsewhere the wings are semi-transparent golden.

Leucinodes elegantalis Guenée, the name under which Dr. Gundlach listed the two specimens he had collected in Puerto Rico, as identified by Herr Möschler, and Dr. Schaus (1940-360) lists subsequent collections at nine Puerto Rican localities, should be **Neoleucinodes elegantalis** (Guenée) according to Mr. Hahn W. Capps, who has studied the "Status of the Pyraustid Moths of the Genus *Leucinodes* in the New World, with Descriptions of New Genera and Species" (Proc. U. S. Nat. Museum, **98**(3223): 69–83, pl. 6. Washington, D. C., 1948). It "has recently attracted considerable attention as a pest of tomatoes in South America, where severe damage to crops has been reported. The damage to crops where *elegantalis* occurs, ranges from unnoted in such places as Cuba and Puerto Rico, negligible in Mexico, to as high as 30 to 80 per cent in Paraná and Minas Gerais, Brazil. The larvae are strictly borers, feeding only in the fruits. Soon after hatching, the young larva bores into the young fruit, and as the fruit develops, the entrance hole is closed. Thus, a fruit that looks perfectly normal, even under a hand lens, may contain one or several larvae. The number of larvae per fruit is usually one, two, or three, but as many as 18 have been found in a single fruit.', The slender little brownish moth has been repeatedly collected at light at Río Piedras, and intercepted at Bayamón. Its hyaline white wings are marked with cinnamon brown areas at base and apex of the fore wings, and less conspicuous bands or areas elsewhere.

Neoleucinodes prophetica (Dyar) is listed by Mr. Hahn W. Capps (1948-76) from Adjuntas, Puerto Rico.

Neoleucinodes torvis was described by Mr. Hahn W. Capps (1948-77), the type from Santiago de las Vegas, Cuba, reared from *Solanum torvum*; others from Río Piedras, Bayamón, Coamo, Utuado, Lares and San Germán, of which "well-marked specimens resemble small examples of *ele-*

gantalis, *dissolvens* and *prophetica*, but are easily separated from them by the very short pubescent-like cilia of antenna."

Ommatospila narcaeusalis (Walker) was identified as *O. nummulalis* Lederer by Herr Möschler for the single female which Dr. Gundlach had collected in Puerto Rico. Dr. Schaus (1940-361) lists additional collections at Coamo and San Germán, and has identified numerous unlabeled specimens. It is a strikingly beautiful little moth, with a complicated pattern of oval and elongated spots outlined in dark brown, and narrow transverse brown lines on the distal margin of areas becoming increasingly darker from a semitransparent, iridescent whitish base.

Hellula phidilealis (Walker) was listed from Puerto Rico as *H. undalis* Hübner by Herr Möschler and Dr. Gundlach, and Dr. Schaus (1940-361) records collections from Ensenada, San Germán, Aibonito and Coamo, and from the Island of Vieques. He identified several unlabeled specimens: small moths with irregular dull yellowish-green stripes and areas on the forewings.

Epipagis cambogialis (Guenée) was re-described as *Botys citrinalis* by Herr Heinrich B. Möschler (1890-282) from a single male collected by Dr. Gundlach in Puerto Rico, and also listed as *Botys cambogialis* Guenée. Dr. Schaus (1940-362) "can find no reason to separate *E. citrinalis*," listing collections at Aguirre, Coamo, Ponce and Guánica. He identified specimens collected at Utuado and at Palmas Abajo by Dr. W. A. Hoffman as this species.

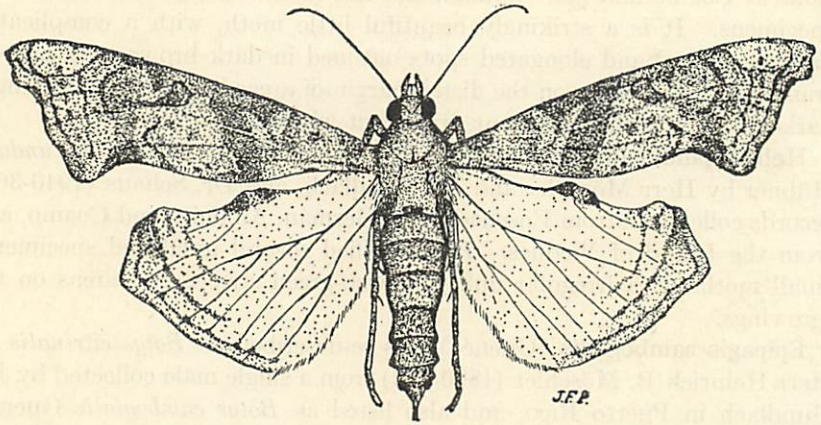
Epipagis conjunctalis was described as a *Samea* by Herr Heinrich B. Möschler (1890-290) from a single female in the Staudinger collection and it is thus listed by Dr. Gundlach. It has not since been found anywhere.

Epipagis mopsalis (Walker) was described as *Botys villicalis* by Herr Heinrich B. Möschler from Jamaica, and listed by him and Dr. Gundlach from Puerto Rico, the latter having three specimens. Dr. Schaus (1940-362) notes collections from Guánica, Coamo, Aibonito, Lares and Cataño, and from the Island of Vieques.

Epipagis togalis (Lederer) was listed as a *Botys* from Puerto Rico by all the early entomologists, but has not since been found locally.

Terastia meticulosalis Guenée was first determined by Dr. Harrison G. Dyar from Puerto Rico: adults from Río Piedras reared from larvae boring in a planting of trees of *Erythrina glauca*, 90 percent of which were infested in September 1921. It has since been found in similar seedlings of *Erythrina berteroana* at Villalba, in the pods of *Erythrina glauca* at Río Piedras, and most destructively in the pods of the cardinal-flowered *Erythrina horrida* at Río Piedras. Adults have been intercepted at light at Bayamón and at Mayagüez, and were collected by Dr. W. A. Hoffman at Utuado and

El Semil, Villalba. In size and shape of the wings it somewhat resembles the other Erythrina shoot-borer, *Agathodes designalis*, but both the costal margin of the hind wing and the inner margin of the fore wing are deeply cleft; its colors are various shades of brown in places speckled with black; and the semi-transparent areas are silvery, not golden.



Adult of the Bucare Seedling and Pod Borer, *Terastia meticulosalis* Guenée, two and a half times natural size. (Drawn by José F. Pietri.)

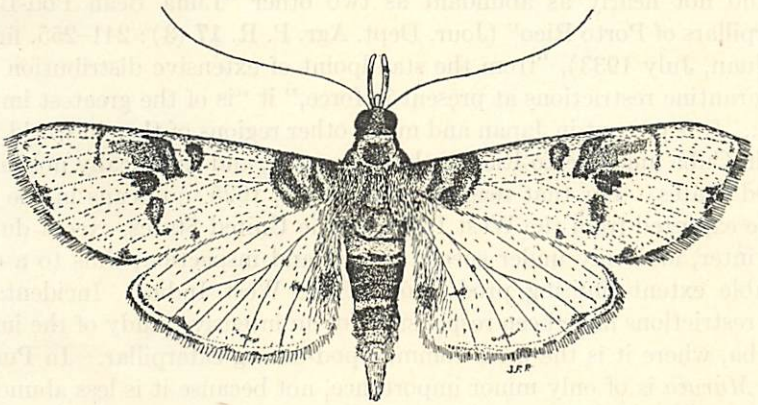
Azochis euvexalis was described as a *Catacteniza* by Herr Heinrich B. Möschler (1890-314) from four females collected by Dr. Gundlach in Puerto Rico and listed by him under this name. Mr. E. G. Smyth collected sixty-four of these "handsome white Pyralids with brown markings" at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and subsequently a single specimen at light at Río Piedras, August 20, 1916. These were identified by Dr. Schaus, who (1940-363) lists additional collections at Arecibo, Coamo, Dorado and from Vieques Island. The iridescence on the clear white areas of the fore wings of this moth is light blue; that of the hind wings is less obviously lavender.

Azochis "probably *rufidiscalis* Hampson" is the identification by Mr. Carl Heinrich of a moth which Dr. Luis F. Martorell reared in the autumn of 1940 from a larva boring in the twigs of "jagüey" (*Ficus stahlii*) at Camuy.

Crocidophora algarrobolis was described by Dr. Wm. Schaus (1940-364), the type collected by Mr. Thos. H. Jones at Algarrobo (near Tortuguero Lagoon) on July 26, 1914: a male with a wing expanse of 20 mm., others from San Juan, Cataño, Dorado, Isabela and Lares, and from Vieques Island. This is what Herr Möschler and Dr. Gundlach list from Puerto Rico under the name *Stenophyes serinalis* Walker, what Dr. Harrison G. Dyar had identified as *Crocidophora zinghalis* Walker, and, as reported in

"Insectae Borinquenses" (1936-464), what Dr. Schaus had identified as *Crocidophora huronalis* Guenée. Its fore wings are mostly light brown with white spots; the hind wings white with deep brown margin and two transverse stripes.

Crocidophora palindialis (Guenée) was described as *Orobena implicitalis* by Herr Heinrich B. Möschler (1890-292) from a male and two females collected by Dr. Gundlach in Puerto Rico, and listed by him. It has since been intercepted at Vega Alta, and listed by Dr. Schaus as a *Crocidolomia.*



Adult of the Jagüey Twig-Borer, *Azochis rufidiscalis* Hampson, **twice natural size.** (Drawn by José F. Pietri.)

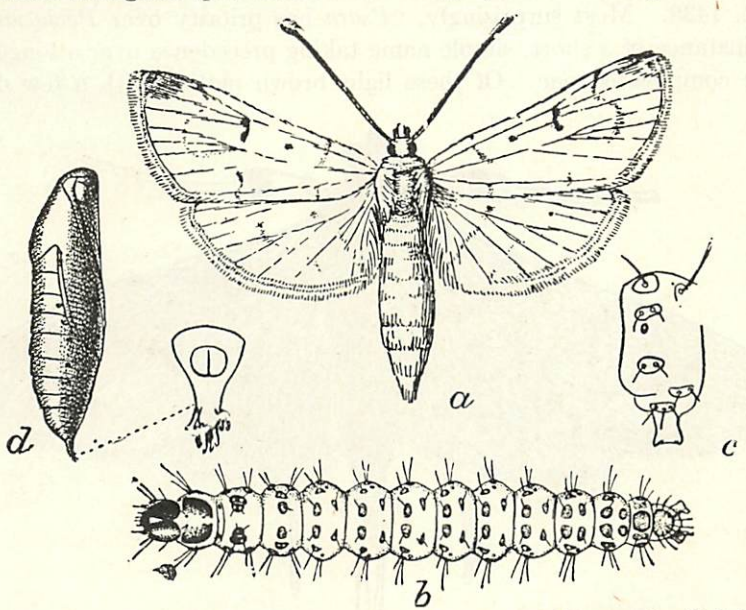
Maruca testulalis (Geyer), as identified by Dr. Harrison G. Dyar, was listed from Puerto Rico as a *Crochiphora* not only by Herr Möschler and Dr. Gundlach, but also by Dr. Schaus. According to Mr. H. W. Capps, "*Crochiphora* is not available for use in the Pyraustidae," and the correct name is **Maruca,** which, fortunately, is the name used in the economic publications on bean pod-borers. Its presence in Puerto Rico was in considerable part responsible for the establishment of the quarantine and inspection regulations governing the importation of vegetables into continental United States. The action taken as a result of a "Report of Hearing Held by the Federal Horticultural Board to Consider the Advisability of Restricting or Prohibiting the Entry from Porto Rico of Fruits and Vegetables into the United States" (Jour. Dept. Agr. P. R., **8** (1): 5–46, pl. 1. San Juan, August 1945) was the "Fruit and Vegetable Quarantine of Puerto Rico Notice of Quarantine of Porto Rico Notice of Quarantine No. 58" (Fed. Hort. Board, U.S.D.A., Washington, D. C., May 27, 1925), enforced by federal inspectors with headquarters at San Juan. These men did not confine their activities to merely inspecting the fruit and vegetables after they were packed for shipment, but visited fruit groves and vegetable farms in all parts of the Island, making "interceptions" of the

insects found there, and thus greatly contributing to the records of hosts and abundance of the insects of Puerto Rico. Dr. Mortimer D. Leonard, at that time working at the Río Piedras Station, and Mr. A. S. Mills, of the F. H. B., published "A Preliminary Report on the Lima Bean Pod-Borer and Other Legume Pod-Borers in Porto Rico" (Jour. Ec. Ent., **24**(22): 466–473. Geneva, April 1931), and on "The Eggs of the Lima Bean Pod Borer in Porto Rico" (Jour. Ec. Ent., **24** (3): 663. Geneva, June 1931), describing the eggs on the leaves and blossom-buds.

Altho not nearly as abundant as two other "Lima Bean Pod-Borer Caterpillars of Porto Rico" (Jour. Dept. Agr. P. R. **17** (3): 241–255, fig. 6. San Juan, July 1933), "from the standpoint of extensive distribution and of quarantine restrictions at present in force," it "is of the greatest importance. It is present in Japan and many other regions of the old world, but only in Cuba and Puerto Rico of the new world, and specifically not in the United States. For that reason, since July 1, 1925, no beans in the pod can be exported from the West Indies to the United States, except during the winter, and only under special permit and inspection, thus to a considerable extent limiting production in the West Indies. Incidentally, these restrictions have been responsible for an intensive study of the insect in Cuba, where it is the most common pod-boring caterpillar. In Puerto Rico, *Maruca* is of only minor importance, not because it is less abundant than in Cuba, but because two other species are so much more abundant and cause much heavier losses. The caterpillars, after burrowing into the pod, have the habit of keeping an exit open to the outside, through which to void their excrement. (This habit is of value to the bean grower, for he is thus able to make sure of all infested pods, and eliminate them as culls when green beans are being prepared for shipment to distant markets.) They are generally of a creamy white and can most readily be distinguished by their spotted appearance, for they generally have four large black or dark grey spots on the back of nearly every segment. Sometimes the spots are not very dark, but usually they are quite distinct, and coupled with the presence of a frass-disposal hole to the outside of the pod, one can usually identify the caterpillar without difficulty." "Methyl Bromide Fumigation for Destruction of Pod Borer Larvae" (Jour. Ec. Ent., **33** (1): 176-9. Menasha, February 1940) conducted on the pier at San Juan by Mr. Randall Latta showed that it caused complete mortality at 0.5 pound per 1,000 cu. ft., at atmospheric pressure in a tightly closed container after two hours exposure at 70° F. temperature. The caterpillars have been found in the wild lima bean (*Vicia faba*), in pigeon peas (*Cajanus indicus*), and in sword beans (*Canavali maritima*), and these are possible alternative hosts for normal infestation in lima beans and string beans. Twenty-six interceptions had been made in lima beans up to 1936; at

Loiza, Río Piedras, Caguas, Cidra, Cayey, Bayamón, Vega Baja, Barceloneta, Arecibo and Isabela, and thirteen in string beans: at Río Piedras, Carolina, Caguas and Manatí. At the Mayagüez Station (1937-43) they were considered "a limiting factor in dry bean production," (1938-60) constituting "approximately 85 per cent of the entire borer population."

"The moth is very active, and when not flying about, stands with wings outspread and all ready to go. The forewings are chocolate brown, with a large white triangular spot on the front margin; the hind wings are silvery

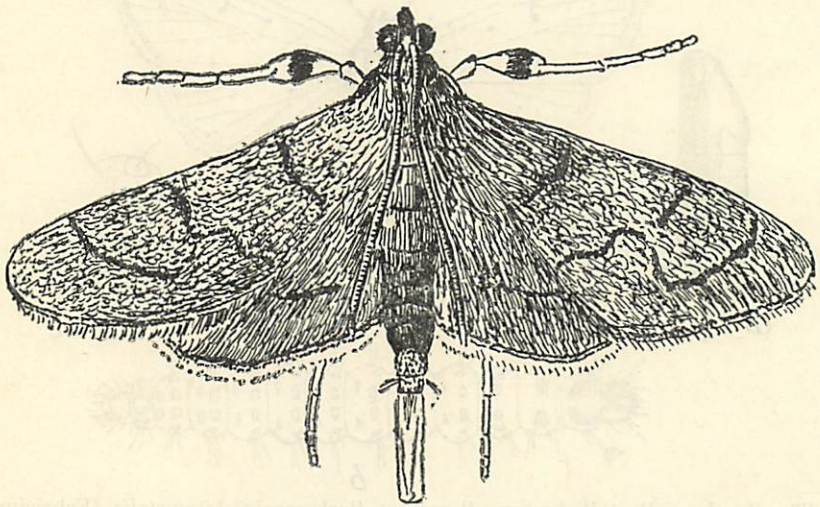


The Southern Beet Webworm, *Psara* (or *Pachyzancla*) *bipunctalis* (Fabricius): *a*, adult; *b*, caterpillar, both about three times natural size; *c*, lateral view of first proleg and abdominal segment of larva (incorrectly showing 2 setae on the pinnacula bearing setae iii and vi: there should be only one each, according to Mr. H. W. Capps); *d*, pupa, three times natural size, and cremaster at right showing location of hooks. (Bureau of Entomology, U. S. Dept. Agr.)

white with a spot" on the apical margin. Of them, Mr. E. G. Smyth collected thirty-four at light at Hda. Santa Rita, Guánica during the latter half of 1913, and they have also been taken at Bayamón and Río Piedras, Dr. Wm. Schaus (1940-365) noting additional collections at Lares, Aibonito and Coamo. Prof. Forbes notes its presence in Haiti, and widely in South America, confirming Herr Möschler's records from French and Dutch Guiana and Colombia to the Argentine. Apparently these records were overlooked in the economic account of distribution.

Psara bipunctalis (Fabricius) is by Dr. Schaus (1940-366) identified

with what Herr Heinrich B. Möschler had re-described from Surinam and Jamaica under the same *Botys terricolalis*, and this is the name used by Dr. Gundlach for his single female from Puerto Rico. Dr. Schaus had previously considered that *Botys detritalis* Guenée, as listed by them, was also in synonymy, and this is indicated in "Insectae Borinquenses" (1936-465). The caterpillar is a common webber of the leaves of "beets, chard and *Amaranthus*," and as a *Pachyzancla* is noted by Mr. Thos. H. Jones (1915-8), Dr. Richard T. Cotton (1918-280), and in Van Zwaluwenburg's list, P. R. 1438. Most surprisingly, "*Psara* has priority over *Pachyzancla*:" one instance of a short, simple name taking precedence over a longer and more complicated one. Of these light brown moths, with a few darker



Adult of the "Pega-Pega del Tabaco," *Psara periusalis* (Walker), six times natural size. (Drawn by G. N. Wolcott.)

spots and wavy lines on the wings, Mr. E. G. Smyth collected over fifty at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and they have repeatedly been taken at light at Río Piedras and intercepted at Bayamón. When viewed at an angle the wings have a lavender iridescence. Adults were reared by Mr. E. G. Smyth at Rio Piedras from larvae on "rabo de gato" (*Achyranthes indica*), and, altho this seems unlikely, on "botoncillo" (*Borreria ocimoides*), as well as on such economic hosts as eggplant and pepper.

Psara periusalis (Walker), a smaller and darker brown moth, was identified by Dr. Harrison G. Dyar as a *Pachyzancla* for Mr. Thos. H. Jones, who (1915-9) noted that "the young larvae live at first as miners in the leaves (of eggplant and *Solanum torvum*), but later web the leaves together."

Dr. Richard T. Cotton in his "Report of the Assistant Entomologist" (in Ann. Rpt. Insular Expt. Station, 1916-17. San Juan 1917), calling it the "Tobacco Leaf-Folder," gives an extended account, with descriptions of all stages, life-history and control, on which is based his subsequent account (1918-299) as a leaf-folder on eggplant. Mr. J. M. Langston found that "The Tobacco Leaf-Folder of Porto Rico attacks Tomatoes in Mississippi" (Quarterly Bull. State Plant Board Miss., 2(4): 7–9. A. & M. College, Mississippi, 1923). Locally it is called "el Pega-pega del Tabaco," being possibly the most abundant insect on shade-grown tobacco, but much less abundant on sunny hills and on tobacco grown in the open. To some extent, the caterpillars may feed on the leaves of the tomato, and on those of *Solanum torvum* and *Solanum nigrum*. The adults have been intercepted at light at Bayamón, and Mr. E. G. Smyth found them very abundant at Guánica, where he collected over a hundred of these "small dusky Pyralids" during the latter half of 1913. Dr. Schaus (1940-367) lists collections at Coamo, Lares and San Germán, but the insect is present in all parts of the Island, being possibly most abundant in the tobacco regions of the interior.

Psara phaeopteralis (Guenée), considered by Dr. Schaus (1940-286) to be what Herr Heinrich B. Möschler (1890-286) described as *Botys intricatalis*, and which Dr. Gundlach thus listed, is specifically and almost exclusively a pest of St. Augustine grass or "grama" (*Stenotaphrum secundatum*). Caterpillars have been noted defoliating this grass at Río Piedras, Santurce, Hatillo, Isabela and Aguirre, but Dr. Mortimer D. Leonard (1932-133) notes that "adults and larvae were also abundant during June in large patches of a weed, "siempreviva" (*Gomphrena globosa*) at El Morro in San Juan:" the only record on any other host than grama. The little brown moths, intermediate in depth of coloration between the other two local species of *Psara*, have been taken at light at Río Piedras, intercepted at Bayamón repeatedly, and at Dorado and Manatí, while Dr. W. A. Hoffman found them at El Semil, Villalba, and Prof. J. A. Ramos (1947-50) on Mona Island. Presumably the insect occurs wherever its host is present, Dr. Schaus (1940-366) noting ten localities at which it has been collected including Aguirre and Ensenada. Most outbreaks on lawns or pastures start in the shade of trees, but before the outbreak has run its course spreads to areas in full sunshine, shaded by trees at no time of day. No parasite of the caterpillars has been reared, but when they have defoliated a section of grass the naked grass stems offer them little protection from grackles and blackbirds, or any other birds that will descend to the ground to eat caterpillars, and both toads and lizards have been observed feeding on them at Isabela.

Prof. Forbes notes the fringe of the hind wing of *phaeopteralis* is all dark, while that of the adult of *periusalis* is tipped with white.

Loxostege bifidalis (Fabricius) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name *Eurycreon evanadalis* Berg, and as a *Phyctaenodes* was identified by Dr. Harrison G. Dyar for inclusion in Van Zwaluwenburg's list: P. R. 1407, and in "Insectae Borinquenses" (1936-466). Mr. E. G. Smyth found this "common buff Pyralid" very abundant at light at Hda. Santa Rita, Guánica, for during the latter half of 1913 he collected 167 individuals, but he did not discover the host of the larvae. It is primarily an inhabitant of the xerophytic regions of the Island, Dr. Schaus (1940-368) listing additional collections at Aguirre, Coamo, Arecibo and San Juan, and on Vieques Island, but it has not been intercepted at light at Bayamón or found at Río Piedras. It is a small, dull cream-colored moth, with broad darker bands on the forewings.

Loxostege nudalis (Hübner), listed by Herr Möschler and Dr. Gundlach as introduced from Spain into Puerto Rico, has not since been found locally.

Loxostege stolidalis was described by Dr. Wm. Schaus (1940-368) from a male from Ensenada, others from Coamo, with a wingspread of 20 mm., mostly buff in color; "markings extremely faint" on the forewings.

Loxostege similalis (Guenée) is considered by Dr. Schaus (1940-367) to be what Herr Heinrich B. Möschler (1890-290) described from a single male, collected in Puerto Rico by Dr. Gundlach, under the name of *Eurycreon collucidalis*. Mr. E. G. Smyth collected 26 adults of this "buff barred Pyralid," identified by Dr. Harrison G. Dyar as a *Phlyctaenodes*, at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and Dr. Schaus records additional collections at San Germán, Guayanilla, Coamo and from Vieques Island. Prof. J. A. Ramos (1947-50) found many specimens, as determined by Prof. Wm. T. M. Forbes, at light on July 20, 1944, Sardinera Beach, Mona Island.

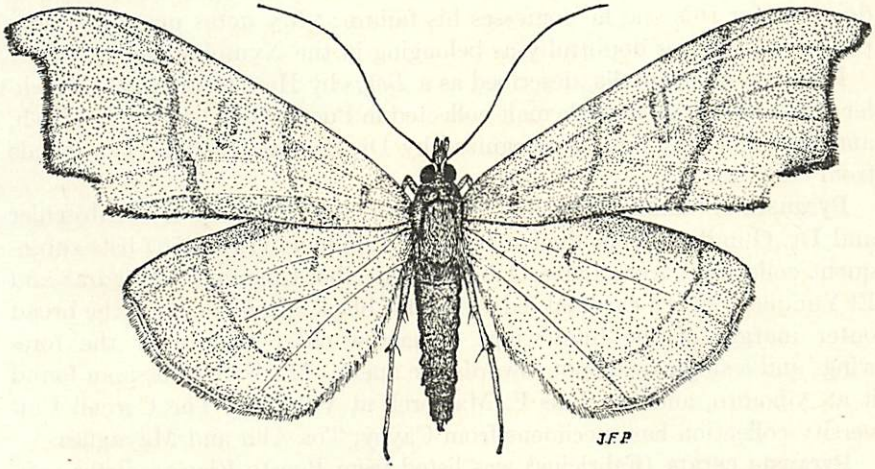
Diasemia ramburialis (Duponchel), of which Herr Heinrich B. Möschler described from two specimens collected in Puerto Rico by Dr. Gundlach the variety *minimalis* (1890-306), is "universally distributed" according to Dr. Schaus (1940-369), and "in the U. S. National Museum there are specimens from Florida, Panama, French Guiana, South Brazil, Argentina and Jamaica all representing the var. *minimalis* Möschler." Adults have been intercepted at light at Bayamón, and collections made at Cataño, Coamo and on El Yunque.

Sparagmia gigantalis Guenée was listed by Herr Möschler and Dr. Gundlach from Puerto Rico, and it has twice since been collected at Lares, and once intercepted at light at San Juan. The caterpillar feeds on "yagrumo" (*Cecropia peltata*) and spins an extensive cocoon of brownish silk. The adult is a large, dark orange moth, its forewings twice deeply cleft on the

outer margin and with two darker transverse narrow bands; a fainter one on the hind wing; a pinkish iridescence at certain angles on areas of both wings.

Tholeria reversalis (Guenée) was re-described as the variety *hilaralis* of *Botys* (*Mecyna*) *polygonalis* Hübner by Herr Heinrich B. Möschler (1890-283). It is not represented in recent collections from Puerto Rico.

Cybalomia evincalis was described as a *Botys* by Herr Heinrich B. Möschler (1890-287) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. It has since been found in Cuba but not in Puerto Rico.



Adult of the Yagrumo Leaf-Webber, *Sparagmia gigantalis* Guenée, three times natural size. (Drawn by José F. Pietri.)

Udea rubigalis (Guenée) as identified by Mr. Carl Heinrich, the celery leaf tier or the greenhouse leaf tier of continental United States, was intercepted as larvae eating the leaves of string beans at San Juan in 1931.

Condylorrhiza vestigialis (Guenée), as identified by Mr. Hahn W. Capps, was collected at light at Villalba, May 19, 1940, by Dr. Luis F. Martorell. This is continental species of which the larva feeds on willow. The adult is an intensely yellow moth, with a faintly darker pattern on the wings.

Hapalia albipunctalis (Dognin) as identified by Mr. Carl Heinrich was collected by Dr. W. A. Hoffman at light at El Semil, Villalba, May 10, 1940.

Hapalia ? concinnalis was described by Herr Heinrich B. Möschler (1890-287) from two females collected in Puerto Rico by Dr. Gundlach and a pair in the Staudinger collection as a *Botys*, and it is thus listed by Dr. Gundlach. Dr. Schaus (1940-371) admits that "I have not been able to identify it in any material that I have seen."

Hapalia eupalusalis (Walker) is listed by Dr. Schaus (1940-371) from Coamo, Lares, Utuado and El Yunque.

Hapalia vinotinctalis (Hampson) is listed by Dr. Schaus (1940-371) from Coamo and Bayamón. Prof. Forbes notes additional collections at Cayey, and at Lares by Mr. Francisco Seín.

Botys ? flammeolalis is described by Herr Heinrich B. Möschler (1890-289) from a single female collected by Dr. Gundlach in Puerto Rico as "ein eigentümliches Tier," with wingspread of 6.3 mm. Despite the valiant effort made by Dr. Schaus to place in their proper genus all the Pyralids described by Herr Möschler in the catch-all genus of *Botys*, of doing so for this one he confesses his failure: "My notes made in Berlin placed this species doubtfully as belonging in the Nymphulinae."

Pyrausta albifrontalis, described as a *Botys* by Herr Heinrich B. Möschler (1890-284) from a single male collected in Puerto Rico by Dr. Gundlach, and thus listed by him, is recognized by Dr. Schaus (1940-374): a female from Guánica.

Pyrausta cardinalis (Guenée) was listed as a *Botys* by Herr Möschler and Dr. Gundlach from Puerto Rico. Dr. Schaus (1940-376) lists subsequent collections from Lares, Aibonito, Arecibo, Coamo, Río Piedras and El Yunque. It is a cardinal red except for black antennae, eyes, the broad outer margin of the hind wings, a narrow outer margin of the fore-wings and a single oval spot towards the apex. Mr. S. S. Crossman found it at Aibonito, and Dr. Luis F. Martorell at Villalba. The Cornell University collection has specimens from Cayey, Toa Alta and Mayagüez.

Pyrausta cerata (Fabricius) was listed from Puerto Rico as *Botys oedipodalis* Guenée by Herr Möschler and Dr. Gundlach, and is in Van Zwaluwenburg's list (P.R. 1411) as *Pyrausta mellinalis* Hübner, identified by Dr. Harrison G. Dyar for Mr. E. G. Smyth, who collected a hundred adults at light at Hda. Santa Rita, Guánica, during the latter half of 1913. In "Insectae Portoricensis" (1923-193), using the name *Epicorsia mellinalis* Hübner, the caterpillar, abundant on "higüerillo" (*Vitex divaricata*) and "péndula" (*Citharexylum fruticosum*), is described, and the three-layered cocoon which it forms in a folded-over leaf of the host tree. The caterpillars are so abundant during some years that one can hardly find anywhere on the Island, a single uninfested tree and most of them are so heavily attacked as to be conspicuous as one drives along the road. Possibly the most widespread outbreak was that of the autumn of 1937, but that noted at only Aibonito and Río Piedras in February 1923 may have been quite as extensive. That of the autumn of 1940, noted in "Trees for Roadside Planting in Puerto Rico" (Caribbean Forester, **6** (3): 115–129, fig. 3. Río Piedras, April 1945) was checked for all parts of the Island: from Cabo Rojo to Isabela, from Patillas to Fajardo, and at numerous intermediate

points. At San Sebastián, Dr. Luis F. Martorell found the eggs, very light green in color, oval, flattened and overlapping, laid on a péndula leaf. The adults are large creamy yellow moths, with a wing expanse of 40 mm., the costal margin of the fore wings brown, and the outer margins of both and sometimes on the abdomen a dorsal stripe in brown.

Pyrausta eupalusalis (Walker), as identified by Mr. Carl Heinrich, is a little iridescent yellowish moth, with darker outer margins on its wings and a faint darker pattern, collected by Dr. W. A. Hoffman at light at El Semil, Villalba, May 10, 1941.

Pyrausta episcopalis (Herrich-Schäffer) was listed as a *Botys* from Puerto Rico by Herr Möschler and Dr. Gundlach, and Dr. Schaus records more recent collections at Lares, Adjuntas, Aibonito and on El Yunque.

Pyrausta gentillalis was described by Dr. Wm. Schaus (1940-373) from a single male from San Juan, with a wing expanse of 13 mm., the "fore wing purplish vinaceous, the costa very narrowly, the termen and inner margins more broadly golden yellow."

Pyrausta glirialis (Herrich-Schäffer), originally described from Cuba, is reported as a *Botys* from Puerto Rico by Herr Möschler and Dr. Gundlach. Dr. Schaus (1940-375) notes an additional collection at Coamo.

Pyrausta gracilalis (Herrich-Schäffer), originally described from Cuba, is listed as a *Botys* from Puerto Rico by Herr Möschler and Dr. Gundlach. It has since been found at Arecibo and Coamo, according to Dr. Schaus (1940-376).

Pyrausta illutalis (Möschler) mis-identified, according to Dr. Schaus, by Herr Möschler (1890-295) from Puerto Rico under the name of *Condyllorrhiza illutalis* Guenée of Brasil, was listed under this name by Dr. Gundlach. Dr. Schaus (1940-374) notes a specimen from Puerto Rico in the U. S. National Museum which he considers "possibly the same as *P. illutalis* (Möschler)."

Pyrausta insignitalis (Guenée) is listed from Puerto Rico as a *Botys* by Herr Möschler: a single specimen collected by Dr. Gundlach. Dr. Schaus (1940-376) notes another from Arecibo.

Pyrausta laresalis was described by Dr. Wm. Schaus (1940-374) from a single female from Lares with a wing expanse of 22 mm., "fore wing olive buff with dark suffusions and irrorations not well defined."

Pyrausta oculatalis was described as a *Botys* by Herr Heinrich B. Möschler (1890-282) from a male and three females collected by Dr. Gundlach in Puerto Rico and listed by him. Dr. Schaus (1940-373) lists "a male in the U. S. National Museum from an old Puerto Rican collection."

Pyrausta phoenicealis (Hübner) was listed as a *Botys* from Puerto Rico by Herr Möschler and Dr. Gundlach. Mr. E. G. Smyth reared larvae at Río Piedras from "marubio botón" (*Hyptis capitata*), several of which were

parasitized by either a black or a yellow Braconid, and others transformed to adults which were identified by Dr. Schaus. This little orange-yellow moth, with somewhat darker broad markings, has been repeatedly intercepted at light at Bayamón, and Dr. Schaus (1940-375) considers it "universally distributed," listing collections at nine Puerto Rican localities.

Pyrausta phyllidalis was described by Dr. Wm. Schaus (1940-373) from a female from Cuba, another from Coamo, with a wing expanse of 28 mm., the thorax, abdomen and legs white, elsewhere orange cinnamon; "fore wing white; costal margin deep chrome at base; markings pale ecru drab." Prof. Forbes collected caterpillars at Coamo in the folded-over leaf of milkweed, *Asclepias curassavica*, which were reared to adult.

Pyrausta tyralis (Guenée) was identified by Herr Möschler and listed by Dr. Gundlach as *Botys diffisa* Grt. & Rbs.: a single female in the Krug collection from Puerto Rico. It has not since been found locally.

Pyrausta viscendalis was described as a *Botys* by Herr Heinrich B. Möschler (1890-285) from a single female collected in Puerto Rico by Dr. Gundlach and listed by him. It has not since been found anywhere.

Pyrausta votanalis was described by Dr. Wm. Schaus (1940-374) from a single female from Pueblo Viejo, with a wing expanse of 10 mm., "palpi, head and thorax ecru drab; abdomen cinnamon buff; fore wing chiefly reddish purple," reared from caterpillars feeding on "molinillo" (*Leonotis nepetaefolia*).

Microtheoris ophionalis (Walker) is listed from Puerto Rico by Dr. Wm. Schaus (1940-377): specimens from Santurce and Aguirre.

Noctuelia thalialis (Walker), as identified by Mr. E. G. Smyth by comparison with illustration in Holland's "Moth Book" (later confirmed by Dr. Schaus), is a "tiny barred Pyralid" of which he collected 160 individuals at light at Hda. Santa Rita, Guánica, during the latter half of 1913. Dr. Schaus (1940-377) lists collections at Aguirre, Aibonito, Coamo, Tallaboa, San Germán and Isabela. The distal third of both wings is brown, as is the base of the forewings, and an intermediate costal area of varying intensity that may reach the inner margin. This is P. R. 1412 in Van Zwaluwenburg's list. Considering how abundant the moths are in the more xerophytic regions of the Island it is rather surprising, as Dr. Schaus remarks, that he "can find nothing in Möschler to agree with this species," and possibly indicates, according to Prof. Forbes, that Herr Möschler mistook it for a Noctuid. Adults have been collected at Palmas Abajo by Dr. W. A. Hoffman, and on Vieques Island by Prof. Forbes.

Mr. H. W. Capps notes this a synonym for **Noctuelia rufofascialis** (Stephens).

Stenoptycha metagrammalis was described as a *Lineodes* by Herr Heinrich B. Möschler (1890-305) from a pair collected in Puerto Rico by Dr.

Gundlach and listed by him. Dr. Schaus (1940-378) lists subsequent collections from the Island of Vieques, and from Río Piedras, Aibonito, Coamo and Adjuntas.

Stenoptycha serpentifera Hampson, originally described from the Bahamas and Cuba, is identified by Dr. Schaus (1940-378) from Puerto Rico: specimens from Coamo.

Lineodes gracilalis Herrich-Schäffer is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but no specimen has been found locally since the male collected by Dr. Gundlach which Herr Möschler re-describes at length.

Lineodes triangulalis was described by Herr Heinrich B. Möschler (1890-305) from three specimens collected in Puerto Rico by Dr. Gundlach and listed by him. It has not since been found locally.

Subfamily Nymphulinae

Argyractis doriscalis is described by Dr. Wm. Schaus (1940-379) from a female intercepted at light at Bayamón with a wing expanse of 15 mm., mostly "citrine drab" in color, patterned on both wings.

Argyractis plusialis (Herrich-Schäffer) was listed from Puerto Rico by Herr Möschler, identifying several specimens collected by Dr. Gundlach as *Cataclysta angulatalis* Lederer. A more recent collection has been made at Coamo, according to Dr. Schaus (1940-380), who neglects to mention his identification of this little grey-brown, sharply patterned Pyralid for Mr. E. G. Smyth, who took 25 of them at light at Hda. Santa Rita, Guánica, during the latter half of 1913, and thought them "rather common." Prof. Forbes found adults common at Coamo, and collected a few on Vieques Island. The larvae of continental species of this genus live in cases attached to stones in swift water.

Nymphula fluctuosalis Zeller, as identified by Prof. Wm. T. M. Forbes, is mentioned by Don Julio García-Díaz (1938-54) as being attacked by the dragonfly *Lepthemis vesiculosa* (F.), at Tortuguero Lagoon during February and March, when "these small white swamp moths were very abundant. These moths flew very low over the water surface, among the emerging aquatics, and so were in part protected from *Lepthemis*."

Nymphula hermeasalis (Walker) is listed by Dr. Schaus (1940-381) from Lares and Coamo, and Dr. W. A. Hoffman collected it at light at El Semil, Villalba.

Nymphula infirmalis (Möschler), described originally as a *Paraponyx* from Jamaica, was identified by its describer for Dr. Gundlach as the two males which he had collected in Puerto Rico. It has not since been found anywhere.

Nymphula rugosalis was described as a *Paraponyx* by Herr Heinrich B.

Möschler (1890-318) from a pair collected in Puerto Rico by Dr. Gundlach and thus listed by him. Prof. Wm. T. M. Forbes identified this species from Laguna Tortuguero for Don Julio García-Díaz (1938–96), and notes collections from Toa Alta and Aguirre. Dr. Schaus (1940–381) lists collections at Coamo and Río Piedras, noting that it is "closely allied to *N. fluctuosalis* Zeller."

Cataclysta bromachalis is described by Dr. Wm. Schaus (1940-382) from a male taken at San Juan which has a wing expanse of 15 mm., "head light pinkish cinnamon; thorax brown, the patagia creamy white; abdomen drab grey with fuscous segmental lines; fore wing silvery, costal margin grayish."

Cataclysta miralis was described by Herr Heinrich B. Möschler (1890-319) from two males and a female collected in Puerto Rico by Dr. Gundlach, and listed by him. Subsequent collections have been made at Lares, Adjuntas, Aibonito, Jájome Alto and on El Yunque, according to Dr. Schaus (1940-381), and Dr. W. A. Hoffman collected some of these striking little moths at El Semil, Villalba and at Utuado. They do not exclusively live in the mountains, however, for they have been intercepted at light at Bayamón and found resting on vegetation in the daytime at San Juan and at Trujillo Alto. The outer margin of their hind wings is a series of small black spots with iridescent golden centers; their fore wings have each four large oval white areas margined in dark brown on a lighter brown background. Prof. Forbes found them especially abundant on El Yunque.

Cataclysta minimalis H. S. is listed by Dr. Stahl.

Cataclysta moniligeralis Lederer was identified as an *Argyractis* by Dr. Schaus (1940–380) from material intercepted at light at Bayamón.

Cataclysta sumptuosalis was described by Herr Heinrich B. Möschler (1890–319) from several specimens collected in Puerto Rico by Dr. Gundlach. Dr. Schaus as an *Argyractis* (1940–380) lists collections at Lares, Maricao, Adjuntas, Coamo, Aibonito, Manatí and Jájome Alto, and Don Julio García-Díaz (1938-96) lists it as a fresh water insect.

Cataclysta opulentalis Lederer was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but has not since been found locally.

Cataclysta vestigialis Snellen, listed from Puerto Rico by Herr Möschler and Dr. Gundlach, is considered by Dr. Schaus (1940-382) to be a misidentification.

Ambia mineolalis was described by Dr. Wm. Schaus from specimens collected on El Yunque, the male having a wing expanse of 14 mm., the female 16 mm., "palpi, head and body white; a small orange spot on tegula, and transverse line on third segment of abdomen; fore wing white; costa narrowly maize yellow (with) dark points."

Bradina hemmingalis Schaus, originally described from Jamaica, is recognized by its describer (1940-384) from El Yunque.

Diathrausta yunquealis was described by Dr. Wm. Schaus (1940-384) from adults of both sexes collected by Dr. Wm. T. M. Forbes on El Yunque. The wing expanse of the male is 14 mm., that of the female 17 mm.; brown moths, marked with white, often edged with black.

Stenia aguirrealis was described by Dr. Wm. Schaus (1940-385) from a male at Aguirre with a wing expanse of 10 mm.; "head and collar white with grayish irrorations; wings with pale ochreous irrorations." The Cornell University collection contains the type, of which Prof. Forbes can note no difference from *Bocchoris acutangulalis*.

Stenia declivalis indianalis (Dyar) is listed by Dr. Schaus (1940-385) from Culebra Island, and from San Germán, Ensenada, Coamo and Palmas Abajo (between Guayama and Jájome Alto) in Puerto Rico.

Stenia pellucidalis was described as *Somatania* by Herr Heinrich B. Möschler (1890-301) from four specimens collected by Dr. Gundlach in Puerto Rico, and listed by him. This moth has not since been found locally, but Dr. Schaus (1940-385) records it from Cuba.

Piletocera bufalis (Guenée), re-described under the name *Penestola praeficalis* by Herr Heinrich B. Möschler (1890–316) from several specimens collected in Puerto Rico by Dr. Gundlach, is listed by Dr. Schaus (1940–386) from both Culebra and Vieques Islands, and from Cataño, Dorado and Ensenada in Puerto Rico.

Odilla noralis was described by Dr. Wm. Schaus (1940-387) from a male from Adjuntas with a wing expanse of 16 mm., "head and thorax vinaceous buff; fore wing apricot buff; hind wing whitish."

Subfamily Scopariinae

Elusia enalis was described by Dr. Wm. Schaus (1940-388) from a number of small moths (wing expanse 8 mm.) from El Yunque, Jájome Alto and Lares, with "head and thorax gray mottled with fuscous; fore wing whitish with dark patches," the markings varying "considerably in the different specimens."

Subfamily Chrysauginae

Salobrena recurvata was described as a *Ballonicha* from Jamaica by Herr Möschler, and listed by him and Dr. Gundlach from Puerto Rico, but has not since been found here.

Carcha hersilialis Walker, according to Dr. Schaus (1940-389), was re-described by Herr Heinrich B. Möschler under the name of *Thalpochares basalis* for the female (1890-169) and as *Coeloma tortricalis* for the male (1890-277), both names being listed by Dr. Gundlach. These little moths have been repeatedly intercepted at Bayamón at light, and were found by Dr. W. A. Hoffman at El Semil, Villalba, May 10, 1941, while Dr. Schaus

notes additional collections at Palmas Abajo, Coamo and Lares. The basal third of the fore wing is dark brown, the median third whitish, the distal third light brown, as is also the hind wing.

Caphys bilinea Walker was re-described from Puerto Rico: two females in the Krug collection, by Herr Heinrich B. Möschler (1890-275) under the name of *Callasopia rosealis*, and it is thus listed by Dr. Gundlach. Dr. Schaus (1940-389) notes a recent collection on El Yunque.

Bonchis munitalis (Lederer) is listed from Puerto Rico as an *Ethnistis* by Herr Möschler and Dr. Gundlach. The queer little brown moths with expanded legs, the tips of the fore wings turned in, have been reared twice at Río Piedras from the seed pods of "roble" (*Tabebuia pallida* or *Tecoma pentaphylla*) and again at San Sebastián in October 1939 from the same host, when all the pods appeared to be infested with the caterpillars. Dr. Schaus (1940-390) lists an additional collection at Aguirre, and presumably the insect will occur wherever its specific host grows. Over half of the fore wing is a black-centered but poorly-developed eye-spot; the base is dark brown, as is also the hind wing and the body of the moth.

Pachymorphus subductellus was described by Herr Heinrich B. Möschler (1890-278) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. Mr. Thos. H. Jones found the larvae boring in twigs of "roble" (*Tabebuia pallida* or *Tecoma pentaphylla*) at Río Piedras in the spring of 1912, and reared the large-snouted, dull purplish-pink adults, as determined by Dr. Schaus. Subsequent rearings from this host at Río Piedras were made in March 1923, and adults found at light in September 1922, intercepted at Bayamón, and reported by Dr. Schaus (1940-390) at Cataño, Aibonito, Coamo and San Germán. This and the preceding species are as different in size and general appearance as can well be imagined, and it is merely by the accident of systematic listing that two moths, the larvae of which happen to feed on the same host, should be placed together.

Epitamyra albomaculalis was described as a *Tamyra* by Herr Heinrich B. Möschler (1890-278) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. It has since been found in Cuba but not in Puerto Rico.

Streptopalpia minusculalis was described as a *Tamyra* by Herr Heinrich B. Möschler (1890-278) from three females collected in Puerto Rico by Dr. Gundlach, and listed by him. Dr. Schaus (1940-391) lists a subsequent collection at San Germán. The Cornell University collection has specimens from Cataño, Río Piedras and Aguirre, in addition to those collected by Prof. Forbes on Vieques Island.

Subfamily Endotrichinae

Perforadix sacchari was described by Mr. Francisco Seín as "The Sugar-Cane Root Caterpillar and other new Root Pests in Puerto Rico" (Jour. Dept. Agr. P. R., **14** (3): 167–191, pl. 10. San Juan, August 1930), having been previously reported as *Sulfetula grumalis* Schaus, as identified by Dr. Harrison G. Dyar. Mr. Seín found larvae boring in the root-tips of sugar-cane at Río Piedras and elsewhere in Puerto Rico, and in Santo Domingo, specific locality records being at Adjuntas, and of adults intercepted at light at Bayamón, and recorded by Dr. Schaus (1940-392) at Coamo and Isabela, and on Vieques Island. Mr. Harry A. Beatty found it on St. Croix, and it will doubtless be found in others of the Lesser Antilles where sugar-cane is grown. Mr. Seín's observations were summarized by Dr. M. D. Leonard (1931–112 and 1931–144), and in "An Economic Entomology of the West Indies," pages 156 to 158.

Micromastra isoldalis was described by Dr. Wm. Schaus (1940-393) from specimens collected on El Yunque, at Jájome Alto and San Germán, the males with a wing expanse of 8 mm., the females 9 mm., thorax and base of abdomen mostly white; wings white with fine grey irrorations, head and markings light drab.

Subfamily Pyralinae

Pyralis manihotalis Guenée, originally described from Java, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Asopia gerontesalis* Walker, but without indication of its economic role. Dr. Richard T. Cotton reared it from larvae feeding on corn meal and on rice, for it is a pest of stored products altho not of great importance. The dirty brown moths have two wavy lines on both wings.

Herculia dissimilalis was described as *Parasopia* by Herr Heinrich B. Möschler (1890-276) from three specimens collected in Puerto Rico by Dr. Gundlach, and listed by him. Dr. Schaus (1940-394) notes subsequent collections at Lares and San Germán. Mr. Carl Heinrich identified as *Herculia psammioxantha* Dyar the adults which Dr. W. A. Hoffman found at light at El Semil, Villalba, on May 10, 1941: inconspicuous greenish-yellow moths with two narrow, curved, transverse lines across the wings. In the late autumn of 1938, the baled alfalfa hay at the Isabela Substation, in which Mr. L. A. Serrano took such pride, was greatly disfigured by the numerous white, thin but dense cocoons of caterpillars which had spun webs over it, in which their excrement was entangled. The injury was really not serious, as comparatively little of the hay was actually eaten, but its appearance was ruined, and Mr. Serrano began to doubt its palatability

for cattle. To the reared adults Mr. Heinrich applied the Dyar name, although considering it in probable synonymy with what Möschler had described from Puerto Rico. It may be presumed that the insect is endemic, although it is doubtful if the larvae of the adults which Dr. Gundlach collected had fed on alfalfa hay.

Subfamily Galleriinae

Galleria mellonella (Linneaus), the wax moth of bee hives, or "traza" as it is called locally, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but without comment. Adults have been intercepted at light at Bayamón, and Mr. Francisco Seín records an infestation at Lares which had destroyed several colonies, but we have no data on abundance on whether it is a really serious pest of wide distribution.

Achroia grisella (Fabricius), as identified by Mr. Aug. Busck, is a small brown moth which Mr. Francisco Seín found very abundant at Río Piedras in June 1925, tunneling thru the comb of which the honey had been centrifuged out, forming dark-colored silk tubes. The comb had been out in the open for some time, near the hive, resting on the ground. This is the "lesser wax moth" of apiaries, and altho present in Puerto Rico is apparently not abundant.

Corcyra cephalonia (Stainton) was first reported from Puerto Rico by Dr. F. H. Chittenden, writing of "The Rice Moth" (Bulletin No. 783, pp. 1–15. U. S. D. A., Washington, D. C., July 14, 1919), of which the eggs were laid in sacks of cereals, the larvae abundant in rice, and also reared from chocolate. Dr. Richard T. Cotton found larvae attacking dry garbanzos or chick peas at Río Piedras, and Mr. Miguel A. Diaz noted them in sesame, with the seeds webbed together to form tunnels and cocoons. Dr. Luis F. Martorell reared adults from larvae in pods of "bayahonda" (*Prosopis juliflora*) at Guánica in January 1914, and they had previously been intercepted in tamarind pods at Guánica, and in bean pods and cotton seed cake at San Juan. The brownish, oval-winged adults have been intercepted at light at Bayamón.

Subfamily Macrothecinae

Pogrima palmasalis was described by Dr. Wm. Schaus (1940-396) from a male collected by Dr. W. A. Hoffman at Palmas Abajo, between Guayama and Jájome Alto. It has a wing expanse of 12 mm., the wings silvery white with pattern in black, the abdomen white; "thorax wood brown; palpi, collar and tegulae vinaceous buff; head pale drab gray."

Genopaschia protomis Dyar, as determined by Mr. Carl Heinrich, was reared by Mr. Mario E. Pérez at Río Piedras from the base of a pineapple fruit. "This is strictly a pineapple insect" writes Mr. C. F. W. Muesebeck

under date of September 10, 1948, "but it is a predator that sometimes feeds on mealybugs occurring on pineapple."

Pseudotricha irenealis was described by Dr. Wm. Schaus (1940-397) from a male from Coamo, mostly brown in color with a wing expanse of 10 mm. Prof. Forbes has additional specimens from Isabela.

Subfamily Crambinae

Crambus biguttellus Forbes, originally described from Louisiana, is listed by Dr. Schaus (1940-398) from Maricao, Jájome Alto and El Yunque.

Crambus discludellus was described by Herr Heinrich B. Möschler (1890-323) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. Dr. Schaus (1940-398) lists additional collections at Lares, Aibonito, Cayey, Jájome Alto and El Yunque.

Crambus domingellus Schaus, was doubtfully identified by Herr Möschler as *Crambus ? ligonellus* Zeller from a single male collected by Dr. Gundlach in Puerto Rico. Originally described from Santo Domingo, its describer (1940-398) identifies it from Puerto Rico: specimens from Lares.

Crambus fissiradiellus Walker was re-described by Herr Heinrich B. Möschler under the name *Crambus gestatellus*, from two males and a female collected in Puerto Rico by Dr. Gundlach. Dr. Schaus (1940-399) lists collections at Lares, Arecibo, Manatí, Coamo, Aguirre and San Germán, as well as from the Island of Vieques. Prof. J. A. Ramos (1947-50) collected two specimens at light on Mona Island.

Crambus ligonellus Zeller was re-described by Herr Heinrich B. Möschler (1890-322) as *Crambus detomatellus* from six males collected in Puerto Rico by Dr. Gundlach, and listed by him. Dr. Schaus (1940-398) lists collections at seven Puerto Rican localities and from Vieques Island. Mr. H. K. Plank found its larvae causing minor "Grassworm Injury to Lawns in Puerto Rico" (Tropical Agriculture **24** (1–3): 7–8, ref. 2. Port-of-Spain, Trinidad, January 1947) on Manila grass, *Zoysia maturella* (L.) Merr. More recently its dark, spotted caterpillars have completely defoliated entire lawns of this grass at Río Piedras, apparently indicating that this newly-introduced grass is a much more acceptable host than any native or naturalized grass previously present on the Island. When fully-grown, the caterpillars construct tough, spindle-shaped cocoons of dark silk, in the outer threads of which are entangled many short bits of grass and excrement. The moths are silvery grey in color, the forewings lavender with the venation outlined in dull orange or yellow; a narrow, doubly-curved darker band across the middle and another paralleling the outer margin inside a line of three conspicuous black spots towards humeral angle, and four others much smaller and less noticeable.

Crambus moeschleralis was named by Dr. Wm. Schaus (1940-398) from

numerous specimens from Cuba, Hispaniola and Puerto Rico of which Mr. Carl Heinrich described the genitalia of both sexes. This species was listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Crambus quinquareatus* Zeller, and identified by Dr. Harrison G. Dyar as *Crambus hastiferellus* Zeller, as recorded in "Insectae Borinquenses" (1936-471), adults resting on sugar-cane at Manatí.

Crambus profanellus Walker is identified by Dr. Wm. Schaus (1940-399) from the Island of Vieques, and from Manatí, Arecibo, Lares, San Germán, Coamo and Aguirre in Puerto Rico.

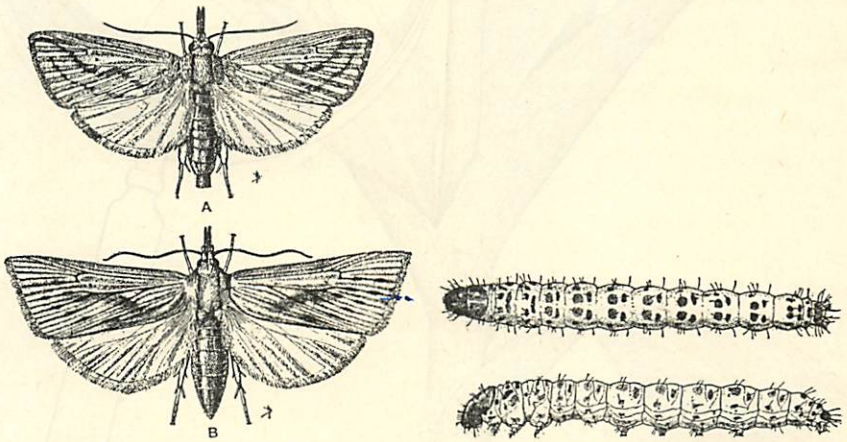
Crambus santiagellus Schaus, originally described from Cuba, is identified by the describer (1940-398) from Coamo and Aguirre, and from Vieques Island. Prof. J. A. Ramos (1947-50) collected one specimen at light on Mona Island.

Argyria diplomachalis Dyar, originally described from Panama and Cuba, is quite common in Puerto Rico, Dr. Schaus (1940-401) listing it from nine localities and from the Island of Vieques. He considers that "this is the *A. nivalis* (Drury) of Möschler, (of which Dr. Gundlach had one male). *Argyria nivalis* (Drury) may occur in Puerto Rico, as it is found in Cuba and Jamaica." It is a little silvery white moth with a brown triangle on costa of the fore wing, approaching the apex, and the outer margin brown.

Argyria lacteella (Fabricius) is listed from Puerto Rico by Herr Möschler under the name *Argyria lusella* Zeller, of which Dr. Gundlach had "ein Parr, welches Snellen nach von Zeller selbst bestimment Stücken mir bestimmte." Dr. Schaus (1940-400) lists it from San Germán, Mayagüez, Aibonito and El Yunque, and from Vieques Island. Presumably his record from Naguabo is what was intercepted at Juncos and identified by him as *A. opposita* Zeller. Apparently it is quite common, for the Cornell University collection has specimens from Cataño, Río Piedras, Santurce, Jájome Alto and Lares. Prof. Forbes notes that it is but half the size of *Argyria nivalis*.

Diatraea saccharalis (Fabricius) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name *Diatraea obliteratella* Zeller, the latter noting "había varios ejemplares en la colección de Krug," without any indication of the host of the larva or its economic importance. It is the lesser sugar-cane moth stalk-borer of the Americas, commonly known as "sugar-cane borer" according to its designation in the "Common Names of Insects Approved by the American Association of Economic Entomologists" (Jour. Ec. Ent., **39** (4): 427–448. Menasha, August 1946). At the time that Dr. Gundlach visited Puerto Rico the value of the coffee exported equalled and often exceeded that of the sugar produced, yet sugar-cane was grown at Hormigueros, Mayagüez and Añasco, and it seems surprising that he should not have collected the moth in person. To be sure,

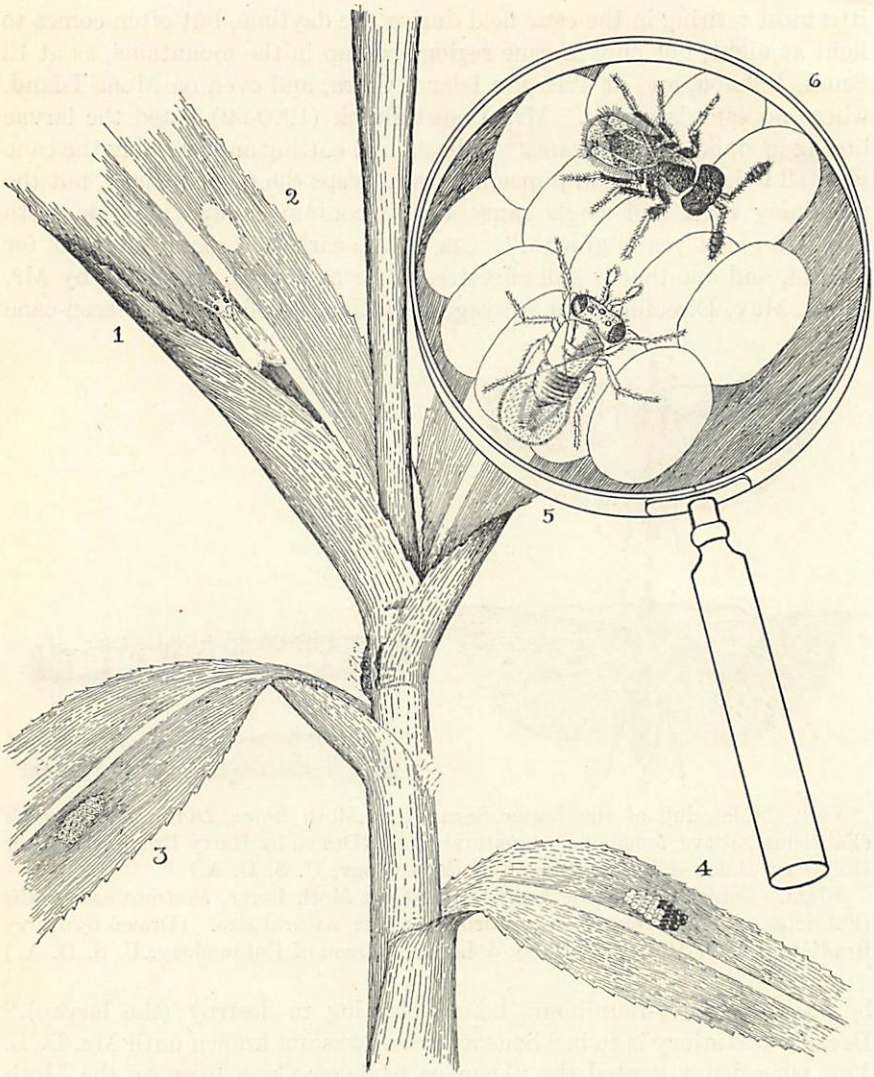
it is most retiring in the cane field during the daytime, but often comes to light at night, not only in cane regions but up in the mountains, as at El Semil, Villalba, and at Treasure Island, Cidra, and even on Mona Island, where no cane is grown. Mr. August Busck (1900-89) noted the larvae boring in stalks of sugar cane. "The annual cutting and crushing the cane with all living larvae and pupae naturally keeps the pest in check, but the remaining roots and single canes always contain enough individuals to infest the next year's growth." One of the earliest recommendations for control, and one that is still effective, so far as it goes, was made by Mr. D. W. May, Director of the Mayagüez Station, (1906-10) that "seed-cane



Left. Male adult of the Lesser Sugar-Cane Moth Borer, *Diatraea saccharalis* (Fabricius), above, female below, natural size. (Drawn by Harry Bradford. After Holloway, Haley & Loftin, Bureau of Entomology, U. S. D. A.)

Right. Caterpillars of the Lesser Sugar-Cane Moth Borer, *Diatraea saccharalis* (Fabricius), viewed from above and from the side, natural size. (Drawn by Harry Bradford. After Holloway, Haley & Loftin, Bureau of Entomology, U. S. D. A.)

be soaked twenty-four hours before planting to destroy (the larvae)." Because the injury is so insidious its extent was not known until Mr. D. L. Van Dine demonstrated the "Damage to Sugar Cane Juice by the Moth Stalk-Borer (*Diatraea saccharalis* Fabr.)" in the very first circular to be issued by the Experiment Station of the Porto Rico Sugar Producers' Association (pp. 11, Río Piedras, 1912). Indeed, Mr. Van Dine gave first place to this pest in his lists of the insects of sugar-cane (1913-28) and (1913-251), even tho white grubs actually caused more serious and certainly more obvious injuries at that time, before the introduction of the giant toad. Mr. Thos. H. Jones prepared the first extended account (Bulletin No. 12, Experiment Station, Board of Commissioners of Agri-



Shoot of sugar-cane on which is resting (1) an adult female of *Diatraea saccharalis* (F.), which has laid a cluster of eggs (2). The egg-cluster (3) has been eaten by ants, (4) is partly parasitized: black, and partly hatched: white. Under the lens, greatly enlarged, is a fresh egg-cluster of the moth-borer being parasitized by *Trichogramma minutum* Riley (5), and by *Prophanurus alecto* Crawford (6). (Drawn by G. N. Wolcott.)

culture, pp. 1–30, fig. 8. Río Piedras, March 16, 1915), and Dr. John R. Johnston (1915-24) the first record of the larva being attacked by the entomogenous fungus, *Cordyceps barberi*, or *Isaria* (*Cordyceps*) *barberi*

Giard, as it was later listed by Mr. J. A. Stevenson (1918-218) and by Miss Vera K. Charles (1941-734). A more intensive study showed the "Influence of Rainfall and Burning the Trash on the Abundance of *Diatraea saccharalis*" (Circular No. 7, Insular Experiment Station, pp. 1–5, map. Río Piedras, 1915) and "The Influence of the Variety of Sugar Cane on its Infestation by *Diatraea saccharalis* Fabr., and the Other Factors Affecting the Abundance of the Moth Borer" (Jour. Dept. Agr. P. R., **6** (1):21–31, fig. 2. San Juan, October 1922), both stressing the importance of the egg-parasite, *Trichogramma minutum* Riley, and the minor role played by the other egg-parasite, *Prophanurus alecto* Crawford. It was found, also, that the lizards *Anolis pulchellus*, *Anolis krugii*, *Anolis stratulus* and *Anolis cristatellus* eat a surprisingly large number of the caterpillars. The effect of "Weather and the Non-burning of Trash in Borer Control in Porto Rico" was presented at the Fourth International Congress of Entomology at Ithaca, New York, August 1928 (**2**: 62–64, ref. 1), in an attempt to summarize what was known at that time of the ecology of this insect.

Mr. Harold E. Box, an English entomologist coming to Puerto Rico from British Guiana, first intensively studied the larval parasites, as his "Report upon a Trip to Porto Rico April–July 1924" (pp. 22. S. Davison & Co., Ltd., Berbice, B. G., November 1924), later expanded to "Observations on *Lixophaga diatraeae* Townsend, a Tachinid Parasite of *Diatraea saccharalis* Fabr., in Porto Rico" (Bull. Ent. Research, **19** (1): 1–6, ref. 11, fig. 1. London, August 1928), and "The Introduction of Braconid Parasites of *Diatraea saccharalis* Fabr., into Certain of the West Indian Islands" (Bull. Ent. Research, **18** (4): 365–370, fig. 2, pl. 1. London, May 1928), shows. He discussed the systematic position of the local economic species in "The Crambine Genera *Diatraea* and *Xanthopherene* (Lep., Pyral.)" (Bull. Ent. Research, **22** (1): 1–50, fig. 5, pl. 5. London, March 1931), and in "The Food Plants of the American *Diatraea* Species" (pp. 11, Port-of-Spain, Trinidad, 1935) listed *Hymenachne amplexicaulis*, *Oryza sativa*, *Panicum barbinode*, *Panicum maximum*, *Pennisetum purpureum*, *Saccharum officinarum* and *Zea mays*. Altho no longer directly connected with Puerto Rico, Mr. Box has continued his investigations on the borer in some of the Lesser Antilles, and most recently in Venezuela.

The book by Mr. F. S. Earle, "Sugar Cane and its Culture" (pp. 355, fig. 24. John Wiley & Sons, New York, 1928) contains a chapter (pp. 162–188, ref. 22) on the "Insect and other Pests of Sugar Cane" giving a practical account of the borer, with recommendations for control that can be adopted by field men. Mr. D. W. May, Director of the Mayagüez Station, in his directions for "Germinating Sugar-Cane" (Agr. Notes No. 38, pp. 2. San Juan, April 1927), notes that soaking in lime water for one day, water alone, or with lime and magnesium, stimulated germination and killed the borer caterpillars. At the Fourth Congress of the International

Society of Sugar Cane Technologists, held at San Juan, March 1 to 16, 1932, some of the field men anticipated that the presence of so many entomologists would result in definite, specific and practical methods of control being formulated. No entomologist was that sanguine, and the discussion of the comparative merits of egg-parasites vs. larval parasites was inconclusive. Dr. M. D. Leonard and Mr. Francisco Seín presented their "Observations on Some Factors which may Affect the Abundance of *Diatraea saccharalis*" (Bull. No. 92, pp. 2), while the paper "On Methods of Determining Borer Abundance in Cane Fields" (Bull. No. 88, pp. 2) was ignored. Eventually, however, "The Introduction of Parasites of the Sugar-Cane Borer into Puerto Rico" (Jour. Agr. Univ. P. R., **21** (2): 237–241. Rio Píedras, July 1937) became the major activity of Mr. S. M. Dohanian in Demerara and Perú. Later reports from the Mayagüez Station (1938-96) indicated that none of the parasites he collected became established, while a native parasite of the larva, *Lixophaga diatraeae* TT reached a high of 31.9% at Hormigueros, and *Bassus stigmaterus* Cresson a high of 4.8% at the same locality in 1936. Dr. K. A. Bartlett renewed the attempts at introducing the "Amazon Fly" (*Metagonistylum minense* TT) into Puerto Rico, making collections from regions in southern Brasil with climatic conditions more nearly similar to those the flies would find here, as is told by him in the "Biological Control of the Sugar-Cane Moth Borer in Puerto Rico" (P. R. Sugar Manual, pp. 7–9. New Orleans, 1938) and "The Collection of Parasites of the Sugar-Cane Borer, *Diatraea saccharalis*, in São Paulo, Brazil" (Sixth Pacific Science Congress, July 1939).

"The Extent to which the Practice of Not Burning Cane Trash has been adopted in Puerto Rico" (Jour. Dept. Agr. P. R., **17** (3): 197–8. San Juan, July 1933) was 84.7% of all fields observed in a trip around the Island made April 3 to 5, 1933. The trend towards decreased infestation due to the non-burning of trash is balanced in recent years by increased infestation due to planting of superior varieties with low fiber content, making them more susceptible to attack. The importance of having exact data on the extent of "Natural Parasitism by *Trichogramma minutum* of the Eggs of the Sugar-Cane Moth Borer, *Diatraea saccharalis*, in the Cane Fields of Puerto Rico" (Jour. Agr. Univ., P. R., **27** (2): 39–83, fig. 1, pl. 6, ref. 14. Río Piedras, June 1944) was fundamental in undertaking experiments in "Control of the Sugar-Cane Borer in Puerto Rico by Laboratory-Reared Parasites" (Jour. Ec. Ent., **36** (3): 460–464. Menasha, June 1943). This was a five year project, taking practically all of the time of Dr. Luis F. Martorell for his part of the field work during that period. As summarized in "Criteria for *Trichogramma*" (Tropical Agriculture, **20** (11): 221–2, ref. 3. St. Augustine, Trinidad, November 1943), conditions

are optimum in Puerto Rico for maximum parasitism during June, July and August, but beginning in September or October and reaching a peak in mid-winter, some fields of gran cultura cane show a deficiency and often a complete absence of *Trichogramma*: a condition which may be promptly changed by the release of laboratory-reared wasps. It is hardly to be expected that this will be surely and decisively reflected a year later, when the cane is harvested, in an obvious reduction in borer injury to the mature stalks, for the tendency of *Trichogramma* is for dispersion, invading check fields as well as high cane, and making impossible an exact statistical proof of the benefits of releases.

Nevertheless, such releases seem to promise more continuing benefits that ground or airplane dusting or spraying with cryolite and various other insecticides tested on a field scale elsewhere, but merely being considered in Puerto Rico. The most promising method of control, a purely incidental benefit among the engineering considerations, is that which may result from overhead irrigation. If the artificial application of water in this way proves to be the equivalent of rainfall, it may partially solve the problem of borer control in areas where it is economically and mechanically possible. To give some indication of the possible value of the newer insecticides, a dozen of them have been applied by overhead irrigation at two week intervals, September–November 1950, in circular areas of two and a half acres at Hda. Santi, Central Cortada.

Diatraea saccharalis is not only a major pest of sugar-cane, but, as shown by Dr. Richard T. Cotton (1918-290), the caterpillars may cause considerable damage to corn. It is not severe, however, because corn is harvested within a few months, and also the caterpillars are more subject to attack by parasites. Elephant grass and other large forage grasses are also sometimes infested, but the most obvious injury is to rice. The stems of rice are so small that the fully-grown caterpillar finds them a tight fit even when it has hollowed them out completely, and just as the crop is approaching maturity many of the weakened stems may droop or fall over, effectually preventing the harvesting of the crop. This is of little importance when rice is merely an experimental crop, but might prevent it from being widely grown commercially in Puerto Rico.

Subfamily Schoenobiinae

Rupela longicornis was described as a *Scirpophaga* by Herr Heinrich B. Möschler (1890-321) from a pair collected in Puerto Rico by Dr. Gundlach, and listed by him. These are large, silvery white moths, with conspicuous tufts of radiating scales on collar and patagia of male; "abdomen long, in female expanding at extremity and with very large anal tuft" of golden scales, of which Mr. E. G. Smyth collected eighty-seven at light at Hda.

Santa Rita, Guánica: seven in July and eighty in October of 1913. In August 1939, Dr. Luis F. Martorell found them on Mona Island, and they have been intercepted at light at Mayagüez and Bayamón. Dr. Schaus (1940-403) records collections at Arecibo, Dorado, Cataño and Río Piedras. The Cornell University collection has specimens from Desengaño (Cartagena Lagoon) and Toa Baja. Both Dr. Gundlach and Herr Möschler also give the name *Scirpophaga leucatea* Zeller, and Dr. Harrison G. Dyar's determination of the Guánica specimens was *Rupela albinella* Cramer, entered in Van Zwaluwenburg's list as P. R. 1410.

Subfamily Epipaschiinae

Pococera atramentalis (Lederer) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach under the name *Phidotricha erigens* Ragonot. It is 1226 on mango and 1626 on *Clerodendron squamatum* in Van Zwaluwenburg's list, and has repeatedly been intercepted at light at Bayamón. Mr. A. S. Mills reared it from the buds of "flamboyán" (*Delonix regia*) and from "almendro" (*Terminalia catappa*). Dr. Schaus (1940-403) records collections from San Germán, Cataño and El Yunque, and from Vieques Island.

Pococera insularella (Ragonot) was listed by Dr. Gundlach and Herr Möschler as a *Tetralopha* from Puerto Rico: a single female collected by the former. Dr. Schaus (1940-404) records collection at San Germán, the larvae from others of the West Indies and in Central America observed feeding on "bulbs of Henequen and Sisal."

Tetralopha scabridella Ragonot was listed from Puerto Rico by Herr Möschler and Dr. Gundlach. In "Insectae Portoricensis" (1923-195) the habits are recorded of the "brown larvae, with lighter-colored medio-dorsal stripe bordered with black, (which) web together several terminal leaves of *Inga vera*, making "nidos de mariposa," at Lares, as determined by Dr. Wm. Schaus, at Cayey, and generally common on host thruout the coffee districts." Dr. Schaus (1940–404) records collection at Villa Margarita, by Prof. Forbes, and Dr. Luis F. Martorell's observation on El Yunque refers to occurrence on the coffee shade trees remaining at Hda. Santa Catalina, where the old road ended and the trail began.

Jocara majuscula (Herrich-Schäffer) was re-described by Herr Heinrich B. Möschler (1890-279) under the name *Deuterollyta infectalis*, and it is thus listed by Dr. Gundlach who collected the type material in Puerto Rico. Dr. Schaus (1930-404) records collection at Adjuntas.

Jocara ragonoti was described by Herr Heinrich B. Möschler (1890-280) as a *Deuterollyta* from a pair collected by Dr. Gundlach in Puerto Rico, and listed by him. Dr. Schaus (1940-405) reports "no specimens," but this should be the common leaf-webber of "mangle de botón" (*Conocarpus*

erecta), repeatedly observed on this host at many points along the coast around the Island, and also noted on Mona Island, identified by Mr. Carl Heinrich as "sp., not in the Museum collection." It is a common, but hardly a serious pest.

Stericta alnotha was described by Dr. Wm. Schaus (Proc. Ent. Soc., Washington, **24**(9): 239. Washington, D. C., December 1922), the type from Puerto Rico.

Subfamily Phycitinae

As the subfamily Phycitinae was omitted from treatment by Dr. Schaus in his "Moths of the Families Geometridae and Pyralididae" (Scientific Survey of Porto Rico and the Virgin Islands, **12** (3): 291–417, see page 329), no systematic arrangement was available for the species present in Puerto Rico, some of which are of considerable economic importance. Of these, the "Mahogany Moth" of the foresters of Trinidad, or the "cedro shoot-borer" as it might more properly be called, **Hypsipyla grandella** (Zeller), is largely responsible for the failure of Spanish cedar or "cedro" (*Cedrela odorata* or *Cedrela mexicana*) in Puerto Rico. The mass attack of its specific leafhopper, causing defoliation long before the leaves would normally fall, might be survived, but the caterpillar of *Hypsipyla* attacks the main shoot of young seedlings in the nurseries, or shortly after they have been transplanted to their permanent location, burrowing into it and causing it to wither and eventually to die. The volunteer new shoots sent out are in turn attacked so that the resulting tree is so gnarled and crooked as to be of little or no economic value, even if it does succeed in attaining marketable maturity. And, as noted by Mr. José Marrero in "Forest Planting in the Caribbean National Forest" (Caribbean Forester, **9** (2): 85–213, fig. 7, ref. 14. Río Piedras, April 1948), "its attacks became more evident in unthrifty stands," so that "large-scale plantings of cedar have been discontinued pending results of investigations." The first record for Puerto Rico is of determination of adults by Mr. Carl Heinrich for Dr. M. D. Leonard (1932-128), whose attention was called by Mr. Wm. R. Barbour to the abundance of the caterpillars "having done considerable damage to about 4,000 young trees at Jayuya and to about 1,000 young trees recently planted at Adjuntas in June 1931; a number of young trees were moderately infested at Lares," but unfortunately he gives an incorrect scientific name for the host and misspells the name of the moth. The adult looks somewhat like a Noctuid, with its dull brown color extending even to the costal margin of the hind wings. The caterpillars are parasitized by an Ichneumonid wasp, identified by Mr. R. A. Cushman as a species of *Calliephialtes*, but these have been reared but once, by Dr. Luis F. Martorell at Cayey in May 1940. That the insect was not known previously may

indicate that it is not endemic, but was accidentally introduced in planting material, or, as it attacks only young shoots on which individual eggs are laid, that although present in small numbers previously, it had no opportunity to become noticeable on the few old native cedros remaining in Puerto Rico.

Hypsipyla muriscus Dyar, as re-determined by Mr. Carl Heinrich, was reared from larvae intercepted at Mayagüez completely destroying the seed of "mamey" (*Mammea americana*).

Acrobasis crassisquamella Hampson, as identified by Mr. Carl Heinrich, has been repeatedly intercepted at light at Bayamón. Dr. J. A. Bonnet found the leaves of an ornamental tree (*Acassia nodosa*) with pink flowers being eaten by these caterpillars at Río Piedras in February 1944. The moths are small and inconspicuous, grey-brown in color.

Homalopalpia dalera Dyar, as identified by Mr. Carl Heinrich, has been repeatedly intercepted at light at Bayamón.

Myelois ceratoniae Zeller, as identified by Mr. Hahn W. Capps, was intercepted as larvae in the pods of tamarind (*Tamarindus indica*) at San Juan and at Arecibo.

Myelois decolor Zeller, as identified by Mr. Carl Heinrich was intercepted as larvae in pods of "algarrobo" (*Hymenaea courbaril*) at Arecibo.

Myelois furvidorsella Ragonot was re-described by Herr Heinrich B. Möschler (1890-326) from two females which Dr. Gundlach had collected in Puerto Rico, and listed (1891-370), without indication of the host of the larva.

Ephestia cautella (Walker), as identified by Mr. Carl Heinrich, was intercepted as larvae at Bayamón feeding on fruits of "icaco" (*Chrysobalanus icaco*), and at Dorado feeding on fruits of "almendra" (*Terminalia catappa*). Mr. L. Courtney Fife (1939-6) found it attacking injured cotton seed.

Crocidomera fissuralis (Walker), originally described from Santo Domingo, is re-described by Herr Heinrich B. Möschler (1890-327) from a single male which Dr. Gundlach collected in Puerto Rico.

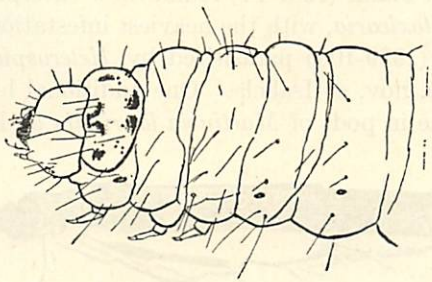
Crodidomera turbidella Zeller is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, and was subsequently identified from unlabeled specimens by Dr. Schaus.

Plodia interpunctella (Hübner), the Indian meal moth, has been found only once in Puerto Rico: by Mr. J. D. More at Río Piedras in April 1921, the larvae feeding on dry dates, and present in great abundance. His identification was confirmed by Dr. Richard T. Cotton, who, in his "Insect Pests of stored grain and grain products," on page 28, writes: "It is handsomely marked and can be distinguished from other grain infesting moths by the characteristic markings of its fore wings. These are reddish brown with a coppery luster on the outer two-thirds, but whitish gray on the

inner or body end." It is doubtful if this pest is a permanent resident in Puerto Rico, but new records may be anticipated if brought in with infested food products.

Cuba furculella Dyar, as identified by Dr. Wm. Schaus, was collected at light by Dr. W. A. Hoffman at El Semil, Villalba, and had previously been determined by Dr. Schaus from unlabeled specimens from Puerto Rico.

Etiella zinckenella (Treitschke), the lima-bean pod borer, was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, the latter having a single female. Dr. M. D. Leonard and Mr. A. S. Mills prepared "A Preliminary Report on the Lima Bean Pod-Borer and other Legume Pod-Borers in Porto Rico" (Jour. Ec. Ent., **24** (2): 466–473). Geneva, April 1931) in which they note the presence of larvae in lima beans, pigeon peas, crotalaria and cowpeas; that cocoons are formed in the ground, the pupal



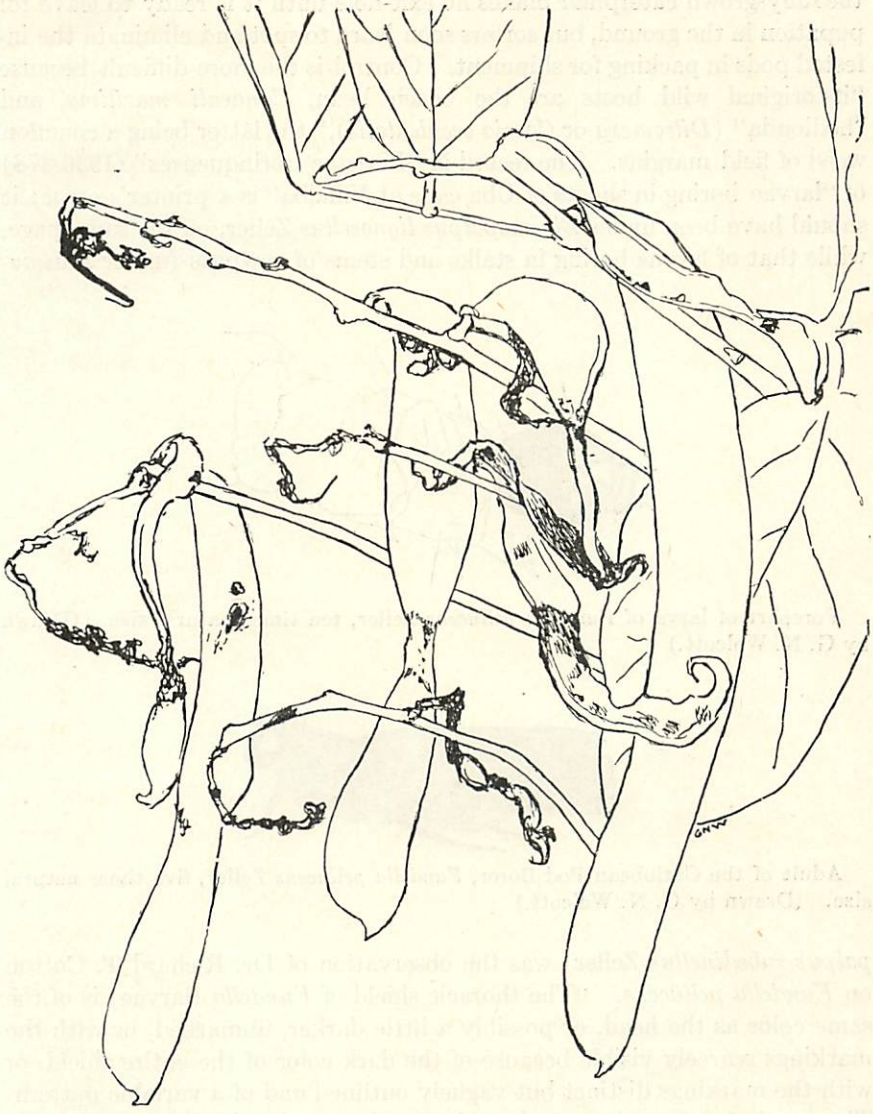
Forepart of larva of *Etiella zinckenella* (Treitschke), ten times natural size. (Drawn by G. N. Wolcott.)

period being less than two weeks and that the caterpillars are parasitized bv *Heterospilus etiellae* Rohwer and an *Eurytoma* near *insularis* Ashmead. Messrs. Richard Faxon and C. P. Trotter (1932-445) record the abundance of these caterpillars in bean pods, and Dr. Leonard (1932-122, 1932-131 and 1933-102 and 122) gives specific locality records in various hosts and on Vieques Island. Indeed, up to 1936, the larvae had been intercepted twenty-seven times in pigeon peas: at Río Piedras, Cataño, Isabela, Aguadilla, Mayagüez, Utuado, San Antonio, Ponce, Peñuelas, Ensenada, Lajas and Arroyo, and repeatedly intercepted in lima bean pods at Bayamón, Isabela and Yauco, and found in pods of *Crotalaria incana* at Isabela and at Mameyes. The first season's continuous observations showed them to be common in lima bean pods at Isabela during the summer, but practically disappearing in the winter when commercial shipments would normally be made to the continental market. Later observations showed little seasonal variation in abundance in the original wild host, *Crotalaria incana* L., and in "Lima Bean Pod-Borer Caterpillars of Puerto Rico on their Wild Hosts" (Jour. Agr. P. R., **18** (3): 429–434, ref. 2. San

Juan, October 1934), they were noted as much more abundant in hairy crotalaria pods of plants growing on sandy beaches than in those growing on heavy clay soil. The eggs are laid between the hairs on the pods, sometimes as many as eight eggs being found on a pod, but one never finds more than one caterpillar inside the pod subsequently. The egg may be, but is not often parasitized by *Trichogramma minutum* Riley. The caterpillar has a yellowish or brownish head, and its body, normally green, may become purplish at maturity. It is readily distinguishable, however, by the thoracic shield, which "is invariably opalescent greenish-yellow, marked with a very definite pattern in black." The fore wings of the adult costally are broadly margined "with silvery white, these margins blending with the white of the legs and abdomen when the moth is at rest. Its large palpi stick out like a beak in front." As noted in the reports of the Mayagüez Station, Mr. H. K. Plank (1937-74) found these caterpillars feeding in the pods of *Tephrosia toxicaria*, with the heaviest infestation (1938-71) during the summer, and (1939-108) parasitized by *Heterospilus etiellae* Rohwer and *Agrophylax* sp. nov. at Isabela. One additional host record is of interception of larvae in pods of *Martiusia laurifolia* at Dorado.

Adult of the Lima Bean Pod Borer, *Etiella zinckenella* (Treitschke), five times natural size. (Drawn by G. N. Wolcott.)

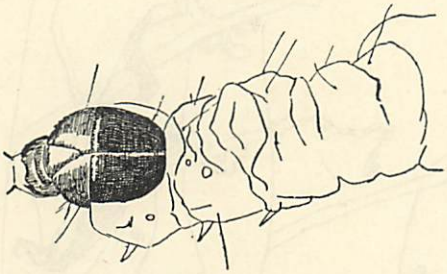
Fundella pellucens Zeller, the Caribbean pod borer, was listed by Herr Möschler from Puerto Rico, where Dr. Gundlach had collected a pair. The material collected by Mr. Thos. H. Jones (1915-8) was most unfortunately mis-identified, so that the name *Pachyzancla bipunctalis* F. was used by him in recording the attack of its larvae on garden beans and the pods of sword beans, *Canavalli ensiformis*. Dr. Richard T. Cotton (1918-292 listed it as *Ballovia cistipennis* Dyar: the stalk and pod borer of cowpeas, originally described from Barbados, and since found in St. Vincent, St. Croix and at Port-au-Prince, Haiti. By Dr. M. D. Leonard and Mr. A. S. Mills (1931-471) and subsequent economic workers it was called *Fundella cistipennis* Dyar, and only recently has its synonymy been shown with what Dr. Gundlach collected here. Mr. Arturo Riollano (1931-113) noted its presence on Vieques Island, and Dr. Leonard (1931-119 and 1932-122, 131 and 135) in cowpeas, pigeon peas, black-eyed peas, lima beans and sword beans from various localities in Puerto Rico. Its real economic importance is as a pest of lima beans during the winter shipping season. Spraying



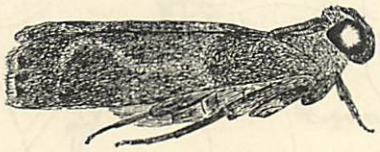
Injury to pods of Sword Bean, *Canavali ensiformis*, caused by caterpillars of the Caribbean Pod Borer, *Fundella pellucens* Zeller. (Drawn by G. N. Wolcott.)

with Bordeaux, arsenicals, rotenone and pyrethrum is ineffective in preventing oviposition or hatching of the eggs, or in killing the small caterpillars before they burrow into the pods, and indeed seems to cause them to seek safety inside the pods earlier than if they were unsprayed. Even

the fully-grown caterpillar makes no exit-hole until it is ready to leave for pupation in the ground, but sorters soon learn to spot and eliminate the infested pods in packing for shipment. Control is the more difficult because "its original wild hosts are the beach bean, *Canavali maritima*, and "hedionda" (*Ditremexa* or *Cassia occidentalis*)," the latter being a common weed of field margins. The record in "Insectae Borinquenses" (1936-478) of "larvae boring in shoots of Uba cane at Villalba" is a printer's error: it should have been under *Elasmopalpus lignosellus* Zeller, on the same page, while that of larvae boring in stalks and stems of cowpeas (under *Elasmo-*



Forepart of larva of *Fundella pellucens* Zeller, ten times natural size. (Drawn by G. N. Wolcott.)



Adult of the Caribbean Pod Borer, *Fundella pellucens* Zeller, five times natural size. (Drawn by G. N. Wolcott.)

palpus rubedinellus Zeller) was the observation of Dr. Richard T. Cotton on *Fundella pellucens*. "The thoracic shield of *Fundella* (larvae) is of the same color as the head, or possibly a little darker, unmarked, or with the markings scarcely visible because of the dark color of the entire shield, or with the markings distinct but vaguely outlined and of a variable pattern. The moth is of a characterless, inconspicuous greyish-brown, with no marked or well-defined pattern on the wings, but with the interesting habit of often keeping the ends of its antennae underneath its folded wings."

Mr. L. B. Scott found that all three of "The Bean Pod Borers in Puerto Rico" (Jour. Agr. Univ. P. R., 24 (2): 35–47, fig. 2, ref. 3. Río Piedras, August 1940) could be controlled with cryolite, and that the small-seeded lima bean, variety Carolina, is highly resistant to their attack.

Elasmopalpus lignosellus (Zeller) was listed by Herr Möschler and Dr. Gundlach from Puerto Rico, the latter having collected several specimens there. This is the lesser cornstalk borer of the southern United States, first noted attacking shoots of Uba cane at Villalba during the summer of 1924 by Mr. Francisco Seín, as reported by Dr. H. L. Dozier (1926-117), but since repeatedly found in fields of young ratoons in which the trash had been burned. The tunnels are smaller than those made by *Diatraea* caterpillars, and cleaner, for the *Elasmopalpus* leave no excrement in their tunnels but live outside in a crack or under debris in a silken tunnel rendered more opaque and less obvious by the drying excrement entangled in its strands. Control in fields of sugar-cane is obtained by not burning trash, for the injury has never been found in fields where the trash remained from the previous crop. At the Mayagüez Station (1937-43), these caterpillars were found attacking dry-bean variety tests on Las Mesas; (1938-57) killing 90 per cent of lima bean plants, also peas and cowpeas, and subsequently (1940-49) attacking teosinte. Their most spectacular attack, however, was at Cerro Gordo on a planting, several acres in extent, of seedlings of "guanábana" (*Annona muricata*) during the late summer of 1945. Of the comparatively few seedlings which survived damping-off, changas and other difficulties, the stem was entered an inch or less below the surface of the ground; the caterpillar boring up and down and leaving little more than a shell of the plump stem of the seedling. The seeds of guanábana had been planted in unshaded, naked beds of sandy soil, with no protecting mulch or trash, and presented a most desirable target for attack by these caterpillars. Living as they do outside of their tunnels, they are mostly dark in color, with a very dark spot dorsally on each segment. The adult is a little grey moth, the central and basal portion of the fore wings being a lighter grey; the hind wings very light and semi-transparent.

Elasmopalpus rubedinellus (Zeller) was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, the latter having collected three specimens. This is a somewhat reddish-brown little moth, of which Mr. Thos. H. Jones found thousands flying over just-plowed land at Maunabo in June 1912, the adults being determined by Dr. Schaus.

According to Mr. Carl Heinrich, neither *Piesmopoda columnella*, nor *P. rubicundella*, described by Zeller from Colombia, but listed by Herr Möschler and Dr. Gundlach, actually occur in Puerto Rico.

Piesmopoda rufulella Ragonot was re-described by Herr Möschler (1890-328) from a pair which Dr. Gundlach had collected and listed from Puerto Rico. It is an insignificant little moth, repeatedly intercepted at light at Bayamón and Comerio, and taken by Dr. W. A. Hoffman at light at El Semil, Villalba in May 1940.

Oligrochroa pellucidella Ragonot was re-described by Herr Möschler

(1890-329) from two specimens which Dr. Gundlach had collected in Puerto Rico, and listed from there. It has not since been found locally.

Oncolabis anticella Zeller was identified by Herr Möschler from a pair which Dr. Gundlach had collected in Puerto Rico.

Nonja exiguella Ragonot is re-described as an *Homoeosoma* by Herr Möschler (1890-330) from a pair which Dr. Gundlach had collected in Puerto Rico.

Homoeosoma maturella Zeller was listed from Puerto Rico by Herr Möschler: a single male collected by Dr. Gundlach and listed by him.

Salebria famula (Zeller) was identified by Herr Möschler from a single female which Dr. Gundlach had collected in Puerto Rico. Mr. Heinrich doubts the correctness of this and the preceeding identification.

Laetilia portoricensis was described by Dr. Harrison G. Dyar, the type from Puerto Rico (Insecutor Inscitiae Menstruus, **3:** 62. Washington, D. C., 1915) collected by Mr. Thos. H. Jones, the larvae feeding on scale insects on pigeon peas at Mameyes, November 1913. Presumably this is their normal habit, as they have since been intercepted feeding on *Saissetia oleae* on African tulip tree or "tulipán" (*Spathodea campanulata*), but Mr. E. G. Smyth reared two of these "small drab moths," as identified by Dr. Wm. Schaus, from withering stems of "Santa María" (*Eupatorium* or *Osmia odorata*), in the summer of 1916. Adults have been intercepted at light at Bayamón. They are little brownish moths, the costal margin of the fore wing a light grey.

Hyblaeidae

Hyblaea puera (Cramer) was listed from Puerto Rico by all the early entomologists, Herr Möschler (1890-183) noting "Raupe auf Crescentia, Tecoma pentaphylla," and in Van Zwaluwenburg's list it is P. R. 124. This is an East Indian and Oriental insect, a serious pest of teak (*Tectona grandis*) there and also attacking *Bignonia* and *Millingtonia*, yet in Puerto Rico it has been observed on none of these hosts. Locally it has been noted repeatedly with the larvae feeding on the leaves of "roble" (*Tabebuia pallida* or *Tecoma pentaphylla*), and on the leaves of the African tulip tree or "tulipán" (*Spathodea campanulata*). Dr. Luis F. Martorell (1939-25) records an extensive outbreak in nurseries at Cayey of "capá blanco" (*Petitia domingensis*) so serious that it was controlled only by spraying with arsenate of lead. The caterpillars feed only at night, during the daytime remaining hidden in the shelter of a folded-over leaf, or, as they become larger, of several leaves held together. Pupation may occur in this shelter, or in leaves on the ground, or in the soil. The adult is a stout-bodied moth showing considerable variation in its markings. The fore wings may be entirely velvety brown, or barred, or with a distinct pattern

of light grey or darker brown; the hind wings with three orange-red or yellow spots on brown, and margined with the orange-red or yellow; the same color being repeated in a narrow transverse band on each abdominal segment.

Thyrididae

Rhodoneura myrsusalis (Walker) was listed from Puerto Rico by Herr Möschler as *Striglina scallula* Guenée, of which he describes a variety *immaculata* (1890-123) "lacking the transparent patch on the fore wing," and both of these were listed by Dr. Gundlach. Prof. Forbes (1930-74) notes this moth as being "general in tropics of both hemispheres," but no recent collection has been made locally, except for a very small specimen from Lares, taken by Mr. Francisco Seín.

Pterophoridae

Pterophorus basalis was described as an *Oedematophorus* by Herr Hein rich B. Möschler (1890-345) and listed by Dr. Gundlach: a single specimen in the Berlin Museum. Prof. Forbes (1931-345) doubtfully identified from Lares "a very poor specimen, but much too large for any other species known to the region."

Pterophorus inquinatus (Zeller), a "mottled gray (moth), with an oblique series of darker shades across middle of (fore) wing; larva on *Ambrosia*"; is listed by Prof. Forbes (1931-345) from Coamo.

Pterophorus paleaceus (Zeller) is listed from Puerto Rico by Herr Möschler and Dr. Gundlach: a single specimen in the Berlin Museum. It has not since been found locally, but Prof. Forbes (1930-77) records from material from the eastern United States "larva varying from greenish white to dull salmon, the shorter hairs sticky, on *Vernonia*."

From leaves of sweet potato, Mr. E. G. Smyth during the summer of 1916 at Río Piedras reared some small brownish moths which Mr. Aug. Busck determined as a species of *Pterophorus*.

Adaina bipunctata was described as *Pterophorus* by Herr Heinrich B. Möschler (1890-346) as "sehr klein," from a single specimen collected in Puerto Rico by Dr. Gundlach and listed by him. Mr. A. S. Mills intercepted larvae on "salvia" (*Pluchea purpurascens*) and adults have been intercepted at light at Bayamón, and collected by Dr. W. A. Hoffman at El Semil, Villalba, at Dorado and in Santurce. Prof. Forbes (1931-345) records additional collections from El Yunque, Aguirre and Coamo, and from Vieques Island.

Adaina praeusta was described as a *Pterophorus* by Herr Heinrich B. Möschler (1890-346) from a single specimen collected in Puerto Rico by Dr. Gundlach, and listed by him. It has been intercepted at light at San

Juan and Bayamón. Prof. Forbes (1930-75) is of the opinion that it "may be a form of the preceding, rubbed specimens of which tend to lose the costo-apical spot."

Adaina participata was described as a *Pterophorus* by Herr Heinrich B. Möschler (1890-346) from a single specimen collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1931-345) records more recent collections at Lares, Coamo and from Vieques Island.

Marasmarcha pumilio (Zeller), a "light brown (moth) with two or three black spots; 15 mm.," has been collected at Naranjito, according to Prof. Forbes (1930–78). He also collected it on Vieques Island, and has specimens from Cataño, Coamo and San Germán.

Trichoptilus defectalis (Walker), as identified by Prof. Forbes (1930-78), has been collected at Coamo, Guayanilla, and Ensenada, and Prof. J. A. Ramos (1947-51) found it on Mona Island. The moth is "light ochreous brown, with faint paler transverse bars; tufts of black scales and some white ones in the fringes; hind wings dark brown, a single larger tuft in the third feather; 14 mm. Larva with large clubbed primary hair and a few secondaries; yellow, with reddish stripes; on *Boerhaavea* and *Amaranthus.*"

Subsequent collections have been made on Vieques Island, and at Palmas Abajo, Aguirre and Coamo.

Sphenarches caffer (Zeller), the Lab-Lab Plume moth, was first reported from Puerto Rico by Prof. Forbes (1930-79), identifying adults intercepted as larvae by Messrs. C. P. Trotter and Herschell Fox on pigeon peas at San Juan, and others previously identified by Mr. Aug. Busck as a species of *Oxyptilus* for Mr. Thos. H. Jones, who had reared them from larvae and pupae on *Caperonia regalis* at Río Piedras in August 1912. From one pupa Mr. Jones thought a parasite had emerged, and another showed indication of attack by a fungus, which was not identified. Prof. Forbes describes this plume moth as being "light ochre, first feather of fore wing dark with pale bars. Fringes with numerous scattered black spatulate scales, which are most numerous in the dorsal fringes, where they tend to gather into tufts. Larva with both clubbed and long simple hairs; pupa spinose, exposed."

Platyptilia crenulata Barnes & McDunnough, originally described from the southern United States, was identified by Prof. Forbes (1931-346) from Puerto Rico: a rubbed specimen from Coamo, "reddish brown, with white subterminal line across both lobes of fore wing, a triangular blackish shade before subterminal line in the first lobe, and another before the notch."

Platyptilia pusillidactyla (Walker) was reared by Mr. E. G. Smyth during the summer of 1916 at Río Piedras on "sacatrapos" (*Caperonia palustris*), the adults being determined by Mr. Aug. Busck. They are described by Prof. Forbes (1930-80) as being "smoky with a pale and dark

band across each feather of the fore wing near its apex. Caterpillar pale yellow, without obvious structures or markings," and (1931-346) collected at Coamo.

Ochyrotica fasciata Walsingham, as identified by Mr. Aug. Busck, has been intercepted on guava leaf at Barceloneta.

Orneodidae

Orneodes eudactyla (Felder) was listed as an *Alucita* from Puerto Rico by Herr Möschler and Dr. Gundlach, and Prof. Forbes (1930-80) records his collection of this species at Coamo.

Tortricidae

Apinoglossa comburana was described by Herr Heinrich B. Möschler (1890-331) from a pair collected in Puerto Rico by Dr. Gundlach and listed by him. It has not since been found anywhere. Prof. Forbes (1930-83) condenses Möschler's description to "fore wing with costal fold in male. Tawny, shaded with yellow-brown, especially on inner margin and before outer margin. Hind wing with inner half shaded with gray. 12 mm."

Paratorna rotundipennis (Walsingham), as determined by Prof. Wm. T. M. Forbes, was reared from numerous larvae, tying together the leaves and almost defoliating a small tree of Hawaiian algarroba or "bayahonda" (*Prosopia juliflora*) at Boquerón during the autumn of 1923. He describes (1930-83) the adults as being "tawny reddish, with waterlines and faint darker shades."

Coelostathma parallelana Walsingham is identified by Prof. Forbes (1931-346) from Lares and El Yunque, and (1930-84) Naguabo, described as "cream-colored, with two transverse fawn bands. 12 mm." It has also been intercepted at Bayamón and San Juan.

Drachmobola insignitana was described as a *Tortrix* by Herr Heinrich B. Möschler (1890-330) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930-84) summarized Möschler's description of the adult as being "pale yellow with darker strigulations on fore wing, and black discal dot. 10 mm.," and notes collections at Aibonito, but (1931-346) with additional material from El Yunque, and what Dr. W. A. Hoffman found at Jájome Alto, notes that "females are considerably darker than implied by Möschler's description, but fit well enough. The male is strikingly different," and gives an extended description.

Sparganothis effoetana was described as a *Tortrix* by Herr Heinrich B. Möschler (1890-330), from single female collected in Puerto Rico by Dr. Gundlach and listed by him. It has not since been collected anywhere.

Prof. Forbes (1930-85) re-describes the adult as having "fore wing powdery rusty brown; terminal line of hind wing also tawny. 18 mm."

Sparganothis flavedana (Clemens), originally described as a *Platynota*, has "palpi long and beak-like, fore wing heavily tufted. Red-brown, the basal three-fourths of the fore wing darker brown, and typically contrasting in male," according to Prof. Forbes (1930-85). He continues "female much larger than male; 10–20 mm.," and records collection from Coamo. On the accession card (880-16) recording the rearing of the adult by Mr. E. G. Smyth during the summer of 1916 from a larva on "jobo" (*Spondias mombin*), Prof. Forbes wrote *Sparganothis* (group *Platynota*). Mr. Smyth considered this identical with another moth which he had reared at the same time from the hairy form of *Malachra rotundifolia*, which he had identified as a species of *Archips*. Prof. Forbes (1930-83) records these as "perhaps *A. jamaicensis* Walker"—a record which cannot stand if his determination of Smyth's material is correct. He notes that the larva of *Sparganothis flavedana* is a general feeder, and Dr. Luis F. Martorell has had adults reared from greenish larvae on "cedro" (*Cedrela odorata*) in April 1941 thus identified. Mr. J. F. Gates Clarke determined as a species of *Platynota* some that Dr. Martorell in June 1940 had reared from larvae feeding on the leaves of "guayacán" (*Guaiacum officinale*) at Salinas. This is the determination of adults reared from larvae intercepted on icaco fruits, from rose, and from "molinillo" at Pueblo Viejo. At the Mayagüez Station (1939-120) it is recorded as a minor pest of vanilla. These records may, or may not, all refer to the same insect.

Mr. Robert Lambert, a graduate student at Cornell University specializing in this group, finds only two specimens from Puerto Rico: one each from Coamo and Lares, and these he considers to be *rostrana*.

Sparganothis saturatana (Walker) is listed by Prof. Forbes (1931-347) from Coamo, having the "fore wing fawn, with brown reticulation and transverse lines toward outer margin. Hind wing orange. 18 mm. This species differs from *S. effoetana* by the orange hind wing, from *S. flavedana* by the smooth fore wing and much larger size."

Olethreutidae

Olethreutes albimaculana (Walsingham) has been identified by Mr. Aug. Busck from material intercepted at light at Bayamón.

Olethreutes anthracana was described by Prof. Wm. T. M. Forbes (1931-347) from a single male from El Yunque which has "head and thorax blackish; fore wing coal black outwardly; a contrasting yellow discal dot," as illustrated in his painting (fig. 2).

Olethreutes canofascia was described by Prof. Wm. T. M. Forbes (1930-86) from a great abundance of material reared by Mr. Thos. H. Jones in

October 1913 and by Mr. E. G. Smyth in July 1916 from "light olive green larvae, the contents of alimentary canal darker, head light brown" webbing together the leaflets of *Phyllanthus lathyroides* at Río Piedras. It has been intercepted at Bayamón and collected at Manatí, but not found elsewhere in Puerto Rico. It is a little brown moth, 12–14 mm. in wing expanse, with a complicated pattern on the forewing in three lighter irregular oval areas.

Olethreutes hebesana (Walker) is a continental North American species, of which the larva is "a stem borer in various herbs. (The adult is) mottled dull brown, the middle of the costa darker," reported by Prof. Forbes (1930-88) from Coamo and collected by him on Vieques Island. Another species of this genus, as identified by Mr. Carl Heinrich, has been reared from larvae intercepted on *Psidium guajava* at Corozal.

The adult reared from larvae intercepted on fruit of "almendra" (*Terminalia catappa*) at Arecibo has been identified by Mr. Carl Heinrich as a species of *Laspeyresia*.

Bactra verutana Zeller is a clay-colored moth "with some fuscous striation, especially on veins and barring toward the margins; with blackish shade-spots, often obsolete, toward base and end of cell," which Prof. Forbes (1931-350) identifies from five Puerto Rican localities and from Vieques Island.

Episimus argutanus (Clemens) is a continental and West Indian species which Prof. Forbes (1931-350) collected on Vieques Island. It is "brown, mottled, with purple iridescence when fresh; a few submarginal black dots towards costa; larva a rather general feeder."

Mr. Aug. Busck identified as a species of *Episimus*, possibly his *guiana*, a moth intercepted on squash at Bayamón.

Gymnandrosoma desotanum Heinrich, originally described from adults reared from larvae in red mangrove seed (*Rhizophora mangle*) found in the Florida Everglades, is identified by Prof. Forbes (1931-349) from his collection of adults on Vieques Island.

Gymnandrosoma trachycerus was described and illustrated in fig. 1 of his colored plate by Prof. Wm. T. M. Forbes (1931-349) from a holotype male, a fuscous and blackish moth from El Yunque, with a wing expanse of 15 mm.

Ethelgoda texanana (Walsingham), as determined by Mr. Carl Heinrich, is a little gray moth, reared from "jumping beans," the infested seeds of "yaiti" (*Gymnanthes lucida*) collected at the Garrochales Forest Station at Arecibo, September 1944. It was "described from Texas, but is undoubtedly of tropical origin, this being the first Puerto Rican record," according to Mr. Heinrich. Mr. Muesebeck writes that "Dr. Bottimer reared this insect in 1929 from seed pods of *Stillingia sylvatica* at Lake Alfred, Florida."

An inconspicuous little brown moth, with no obvious markings, of which the larva webs together and feeds on the tender leaves of "María" (*Calophyllum antillanum*) found in the spring of 1940 near Laguna Tortuguero, as reported by Dr. Luis F. Martorell (1948-114) who reared the material, was determined by Prof. Wm. T. M. Forbes as a new species of *Episimus*.

Anchyloptera virididdorsana was described as a *Phoxopteryx* by Herr Heinrich B. Möschler (1890-334) from two specimens collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930-89) collected it at San Germán and on Vieques Island. It is an orange-ochre moth, "shaded with green, a triangular green patch on inner margin of fore wing; hind wing gray with three metallic strigules near margin; 8–10 mm."

Thiodia autochthones Walsingham was collected by Prof. Forbes (1931-350) at San Germán, and he records collection by Dr. M. D. Leonard and Mr. A. S. Mills at Cataño and Aguirre. It is "mouse grey, strigulated; the most conspicuous mark being an ochreous patch near anal angle, containing two black dots, preceded by lead gray and followed by a whitish spot, a continuous black basal line in fringe; 8 mm."

Eucosma longipalpana was described as a *Grapholitha* by Herr Heinrich B. Möschler (1890-333) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. It is a pale yellow moth, not since found anywhere.

Eucosma strenuana (Walker), originally described as a *Grapholitha* from Santo Domingo, Prof. Forbes (1930-90) collected at Coamo and Isabela in Puerto Rico and on Vieques Island. It is a smoky moth, "more or less dusted with white," of which the "larva (is) a stem-borer in *Ambrosia*."

Crocidosema plebeiana Zeller is a common, tropicosmopolitan, mottled brown moth, collected on Culebra Island by Mr. Aug. Busck in 1899, and by Prof. Forbes (1931-350) on Vieques, and taken at light at many localities in Puerto Rico. It has been reared from larvae intercepted in seed-heads of *Sida cordifolia* at Vega Alta, by Mr. A. S. Mills.

Strepsicrates smithianus Walsingham, as identified by Mr. Aug. Busck, was reared by Mr. E. G. Smyth at Río Piedras during the summer of 1916 from guava (*Psidium guajava*), together with some Braconid parasites which were not identified. Prof. Forbes (1930-91) records collection at Naguabo and on El Yunque, describing the adult as "dark brown, inner margin light gray, outer part of costa mottled with light gray; hind wing translucent blue-gray, with smoky border and veins."

Heligmocera calvifrons Walsingham was collected by Prof. Forbes (1930-92) on El Yunque. The "base and disc (of the fore wing is) largely dull rose, outer part and inner margin olive green, shaded and mottled with blackish; 14 mm."

Balbis excitana was described as a *Grapholitha* by Herr Heinrich B. Möschler (1890-333) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. Don Julio García-Díaz (1938-96) lists it, identified with some doubt by Prof. Forbes, as having been collected by him in some aquatic environment, possibly on El Yunque.

Epinotia unica Heinrich is listed by Prof. Forbes (1931-351) as having been collected by him at Isabela, a single undersized male.

Phaloniidae

Saphenista bunteoides was described and illustrated (fig. 3 of his colored plate) by Prof. Wm. T. M. Forbes (1931-353) from material from Coamo, having the head, thorax and basal portion of fore wing cream-colored. It has since been found by Dr. W. A. Hoffman at Utuado.

Saphenista lepidulana was described and illustrated (fig. 4 of his colored plate) by Prof. Wm. T. M. Forbes (1931-354) from specimens he had collected at Coamo, El Yunque and from Vieques Island, the "ground of the fore wing darker ochreous and more even."

Saphenista multistrigata Walsingham-Durrant is identified by Prof. Forbes (1931-354) from specimens collected by him at Coamo and on El Yunque, and by Dr. W. A. Hoffman at Jájome Alto.

Saphenista semistrigata was described and illustrated (fig. 5 of his colored plate) by Prof. Wm. T. M. Forbes (1931-355) from material he collected on El Yunque and from Coamo, the fore wing having "a defined olive streak." This has been reared by Mr. A. S. Mills from larvae intercepted on *Pluchea purpurascens* at Pt. Cangrejos. Other species of this genus have been collected at light on El Yunque, or intercepted at light at Bayamón.

Phalonia distigmatana Walsingham, originally described from St. Vincent and Grenada, was collected on January 1899 by Mr. Aug. Busck at Bayamón, and has since been taken at Isabela by Prof. Forbes (1931-355). It is a cream-colored moth with fawn-brown markings, a wing expanse of 9 mm.

Phalonia prolectana was described as a *Cochylis* by Herr Heinrich B. Möschler (1890-332) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. It has not since been found anywhere.

Phalonia subolivacea Walsingham was collected at Bayamón in January 1899 by Mr. Aug. Busck. It is presumed that it was this "tiny brown and white moth" which Mr. E. G. Smyth during the summer of 1916 at Río Piedras reared from flower heads of *Erechthites hieracifolia*, and it was definitely identified as this species which Mr. A. S. Mills intercepted at Dorado and Guayama in flower heads of "margarita" (*Bidens pilosa*). Prof. Forbes (1930-95 and 1931-355) records collection from seven Puerto

Rican localities and from Vieques Island of this moth "creamy white with olivaceous markings."

Phalonia tectonicana was described as a *Cochylis* by Herr Heinrich B. Möschler from a single specimen collected in Puerto Rico by Dr. Gundlach and listed by him. It has not since been found anywhere.

Phalonia vincinitana was described as a *Cochylis* by Herr Heinrich B. Möschler (1890-333) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. This pale yellow moth marked by with brown has not since been found anywhere. The little moths reared from larvae boring in the buds of dahlias at Río Piedras in the summer of 1922, causing them to wither, were identified by Mr. Aug. Busck as a species of *Commophila.*

Cossidae

Psychonoctua personalis Grote was described by Dr. C. W. Hooker (1913-35) as "a lepidopterous borer, determined by Dr. H. G. Dyar as *Psychonoctua* sp., which was reported as the 'coffee stem-borer' by Mr. W. V. Tower (1908-27) as boring in orange, citron, rose-apple and sweet-al-

Larva of *Psychonoctua personalis* Grote in its tunnel in the coffee trunk. Natural size. (Drawn by F. Seín.)

mond, has done considerable damage, where the trunks and larger branches of the coffee plants are riddled with canals." In his summary of the "Insects Affecting Coffee in Porto Rico" (Jour. Ec. Ent., **10** (6); 513–517. Concord, December 1917), Mr. R. H. Van Zwaluwenburg noted that it is "most often found in old coffee at altitudes up to 1,500 feet," and recommends pruning and burning invaded wood for control, giving Dr. Dyar's determination of *Psychonoctua jamaicensis* Schaus. It was subsequently identified by Dr. Wm. Schaus as *Xyleutes muricolor* Dyar MS, but male genitalia studies unite *P. personalis* Grote, *P. jamaicensis* Schaus and the Porto Rican race under the name of the Cuban species. Altho individuals may occur in the higher coffee groves, as at Indiera, Lares and Villalba, serious injury has been noted only at lower elevations, as at Vega Baja, Quebradillas and Aguadilla, and the most severe attack was on coffee growing in an experimental plot on the grounds of the Mayagüez Experiment Station under *Gliricidia* shade. Mr. T. B. McClelland had planted this on level land, intending to run fertilizer experiments without the complica-

tions due to uneven contour of commercial groves, but the damage by these borers was so excessive that the experiment had to be abandoned. Apparently the moths normally and by preference occur close to sea-level, and attain a much greater size in shoots of "mangle" (*Laguncularia racemosa*), as around Laguna San José in 1938, than they do in coffee. They have also been found attacking croton bushes at Río Piedras, and Prof. J. A. Ramos (47-51) found them in seagrape (*Coccoloba uvifera*) on Mona Island. In coffee trees, infestation may cause warty growths somewhat similar to that produced by heavy infestations of the "hormiguilla," but in mangrove, no indication of infestation appeared until the exit tunnel was formed. The pupal skin of the insect is left in the tunnel when the moth emerges. It is "gray with inconspicuous light brown markings," of great variation in size, some individuals having a wing expanse of two and a quarter inches, others not measuring even an inch from tip to tip.

Hyponomeutidae

Urodus sordidata was described as a *Trichostibas* by Herr P. C. Zeller (Horae Societatis Entomologica Rossicae, xiii, p. 233. 1877), the type from Puerto Rico, and apparently it has not since been found anywhere.

Hyponomeuta triangularis was described by Herr Heinrich B. Möschler (1890–339) from two males collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930–99) calls this *Yponomeuta* one of the "Small Ermine Moths," and it is indeed silvery white, "Vorderflugel weissgrau mit 21 schwarzen Punkten" according to the count by Herr Möschler, altho some individuals have 27 or more black spots on the fore wing, if one counts the smallest ones. The larvae have been found making nests between leaves of "coscorrón" (*Elaeodendron xylocarpum*) at Boquerón, Arecibo, Pt. Salinas and Loíza Aldea, and indeed may be expected wherever this shrub or tree occurs along the beaches. As noted in "Insectae Borinquenses" (1936-484), "the full-grown larva is 14 mm. long, with an orange-yellow head. Body is canary yellow; an irregular medio-dorsal black spot on each abdominal segment, laterally bordered with white, lateral of which is a much larger irregular, black, grey-bordered spot. On the second and third thoracic segments, these large later spots are broken in two by median white bands; on the first segment are two black crescents only. True legs black, spiracles black, lateral hairs with black areas at base, prolegs black and white banded."

Euarne obligatella was described by Herr Heinrich B. Möschler (1890-340) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. It has not since been found anywhere.

Plutella maculipennis (Curtis), the cosmopolitan diamondback moth of cabbage, was identified by Herr Möschler from a single male collected in

Puerto Rico by Dr. Gundlach, which he thought "enteramente parecido a los europeos; era acaso introducido." It has become much more abundant since, and was noted by Mr. O. W. Barrett (1904-448) on cabbage, and by Mr. W. V. Tower (1908-35) on cabbage, kale, mustard and turnips. Mr. Thos. H. Jones (1915-9) gives an illustration of an injured mustard leaf, and Dr. Richard T. Cotton (1918-281) illustrations of all stages and considers it "the worst insect pest of cabbage in Porto Rico." It occurs in all parts of the Island, and has been repeatedly taken at light, even in areas where no cruciferous vegetables are grown, as in Guajataca Gorge, but Dr. Hoffman's collection at El Semil is hardly surprising, as larvae have been intercepted on brocolli at Villalba. Control in the past has been exceptionally difficult because of the unadhesiveness of most chemicals to the waxy cabbage leaf. Pyrethrum dust has given control, if used when fresh, but DDT dust is even more effective, and for the present at least can be recommended without reservation for use by cabbage growers until something more desirable is synthesized by the organic chemists. Prof. Forbes (1930-100) describes the adult as "brown, the inner margin of the fore wing in the male contrastingly paler, taking the form of a series of overlapping half-diamonds, female with the same markings but not contrasting."

Glyphipterygidae

Tortyra aurofasciana (Snellen), originally described from the Island of St. Martin in the Lesser Antilles, was listed as a *Choregia* by Herr Möschler, identifying two males from Puerto Rico collected by Dr. Gundlach, and listed by him. Prof. Forbes (1930-102) notes collection at Guánica and Guayanilla, and (1931-356) by Dr. M. D. Leonard on Vieques Island.

Brenthia pavonacella Clemens seems to bear a singularly appropriate specific name, altho it actually holds its dark brown wings in a manner quite the reverse of that of a strutting turkey, displaying their upper surfaces marked and spotted with white, and iridescent lavender spots on the outer margin of the fore wings. It was listed from Puerto Rico by Dr. Gundlach and Herr Möschler, and is quite common in coffee groves and even in citrus groves, resting on low vegetation. Mr. Carl Heinrich, identifying adults from Indiera, Adjuntas and Utuado, added that the larva "feeds on *Amphicarpea*," and in November 1931, Mr. Francisco Seín found them abundant, feeding on the underside of the leaves of the coffee shade tree, *Inga vera*, at Lares. Most recently at Mayagüez, Mr. H. K. Plank (1945-27) found them a serious pest on soybeans.

Heliodinidae

Heliodines quinqueguttata Walsingham was collected on Culebra Island by Mr. Aug. Busck in February 1899, and is reported by Prof. Forbes

(1931-356) from Dorado and Aguirre. He describes the moth as being "golden-orange, fore wing with three bronzy spots on costa, alternating with two on the inner margin; apical third of fore wing edged with bronzy; 8.5 mm."

Cosmopterygidae

Batrachedra albistrigella was described by Herr Heinrich B. Möschler (1890-345) from a single specimen collected in Puerto Rico by Dr. Gundlach, and listed by him. It is "light gray-green striped with white, the hind wing mostly white," according to Prof. Forbes (1930-107), and has not subsequently been found anywhere.

Mr. Francisco Seín, studying the insects present in ripening and mature pineapple fruits as they might be implicated with the excessive production of gum exudations from injured (or uninjured) portions of the fruit, found that the most common small caterpillar present was a species of **Batrachedra**. Prof. Forbes thought that it might be a new species, but Mr. J. F. Gates Clarke identified it as "near, if not **mathesoni** Busck," originally described from Florida, where its larvae were found on the blossoms of the coconut palm. These minute little elongate silvery-gray moths have prominent black eyes, the markings on the fore wings consisting only of a single submedian spot. Mr. Seín found exudations of gum from areas eaten into the base of the fruit by the caterpillars, from near-by such areas, and also from portions of the fruit far distant from caterpillar injury, indicating only a facultative connection between gumming and the *Batrachedra* larvae. His preliminary report is entitled "Estudio del Daño causado por los Insectos a las Piñas" (*in* Informe Bienal, 1940–42, pp. 83–85. Río Piedras, 1944). Mr. Mario Pérez, continuing the studies, found decisive reduction in gumming and caterpillar injury following spraying with chlordan.

Cosmopteryx antillia was described by Prof. Wm. T. M. Forbes (1931-356) from Coamo, "closely similar to *C. mimetis*," which was the identification he (1930-108) had formerly given to these specimens.

Cosmopteryx attenuatella (Walker), as identified by Mr. Aug. Busck, was intercepted in the metropolitan area, and Prof. Forbes (1930-107) records collection at Coamo. The adult has "antenna with four segments at tip white, then five black, one white and one black."

Cosmopteryx gemmiferella Clemens was identified with some doubt by Herr Möschler, as Dr. Gundlach had but a single injured specimen from Puerto Rico, and Prof. Forbes "strongly suspects" that it was *C. attenuatella*.

Cosmopteryx sancti-vincenti Walsingham is listed by Prof. Forbes (1930-108) from Coamo and El Yunque.

Cosmopteryx similis Walsingham was collected by Prof. Forbes (1930-108) on Vieques Island and at Coamo.

Triclonella rhabdophora was described and illustrated by Prof. Wm. T. M. Forbes (1930-135) from a type collected by him on St. Thomas, others from Vieques Island. It is a small, narrow-winged, ochre yellow moth, striped with dark brown.

Pyroderces stigmatophora (Walsingham), extensively recorded in economic literature as *Pyroderces rileyi* (Walsingham), and thus first identified from Puerto Rico by Mr. J. D. More, has a slender pinkish larva, often found in old cotton bolls, and because of the color, often confused with the pink bollworm of cotton. In Puerto Rico, it has been most often collected in old cotton bolls because of the intensive studies made on pink bollworm, but it also attacks seed corn, and is known as the pink corn worm. Dr. M. D. Leonard (1932-131) records its interception by Mr. A. S. Mills on dry cowpea stems from Vieques Island, and it has repeatedly since been found heavily infesting the heads of only partially mature sorghum on the PRACO farm on Vieques Island. It was not found by Mr. Aug. Busck when he was in Puerto Rico in 1899, but he has repeatedly identified it from here since, and he is responsible for a most extensive critical discussion of what he calls "the scavenger bollworm" (pp. 362-366) in his technical paper on "The Pink Bollworm, *Pectinophora gossypiella*" (Jour. Agr. Research **9** (10): 343-370, fig. 7, pl. 6, ref. 48, Washington, D. C., June 4, 1917). "Aside from the color of the larva, there is only a superficial resemblance between it and the pink bollworm; and even the color is somewhat different—much deeper and more reddish. Full grown, it is much smaller than the pink bollworm, and appears more hairy because of the proportionally longer setae." The adult has very narrow wings, and is quite different in general appearance from the pink bollworm adult. Large numbers were found killed in the Isabela ginnery after its interior had been sprayed with 5% DDT in kerosene, but this is hardly a commercial method of control, even in instances where control is considered desirable. The old cotton bolls and stored corn attacked are usually valueless by the time injury is noted, but some preventive to its attack on ripening sorghum is needed if this is to be grown commercially on Vieques Island.

Homaledra sabalella (Chambers), as determined by Mr. Aug. Busck, is much more obvious in the injury caused by the feeding of its caterpillars on the underside of palm leaves, and the web of loose silk, in which most of its brown excrement becomes entangled, than as whitish caterpillar, or as elongate grey-brown adult. Injury to the areca palm has not been noted, nor to the royal palm, but to the coconut palm is sometimes so severe as to be of commercial importance, and such ornamental palms as the fan palms (*Coccothrinax argentea*, *Neowashingtonia robusta* and *Livistona chinensis*), are ruined from the standpoint of appearance. The imported cahoun palm, the oil palm (*Elaeis guineensis*), the sugar palm

(*Arega saccharifera*), and the native mountain palm (*Euterpe globosa*) are also attacked. This may be an endemic insect, altho its range extends to Hispaniola and Florida. The caterpillars are attacked by two species of *Spilochalcis*, but this by no means results in even commercial control. Spraying ornamental palms with nicotine sulfate will prevent re-infestation for a considerable period, but does not bring back the original appearance of injured leaves, and they should be cut off and removed even if all living caterpillars have already left them. The insect occurs in all parts of the Island, mountain-palms being attacked on El Yunque, and coconut palms at Guánica and on Vieques Island, but it is not reported from Mona. Prof. Forbes (1930-109) describes adults as being "clay color, with black dots in fold and at end of cell; 15 mm."

Prochola fuscula was described by Prof. Forbes (1931-357) from a type collected by him on Vieques Island, others from Coamo: a little fuscous moth, 8 mm. in wing spread.

Perimede annulata Busck was identified with some doubt by Prof. Forbes (1931-358); a single female from Cataño, "deep bronzy brown-black, with four raised scale-tufts on fore wing."

Perimede purpurescens was described by Prof. Forbes (1931-358) from a single female collected by Mr. Francisco Seín at Lares, "umber brown, the thorax and fore wing with decided iridescence, in most lights violet blue, but changing to crimson; immaculate; last ten segments of antennae white."

Eriphia curvipunctella (Walsingham) is listed as an *Eritarbes* from Puerto Rico by Prof. Forbes (1930-110) collected by Mr. R. H. Van Zwaluwenburg, but later he (1931-360) admits "I am not sure of my identification" of specimens from Isabela, Coamo, Santurce and Vieques Island.

Eriphia pernigrella was described by Prof. Wm. T. M. Forbes (1931-360) from a coal black type which he had collected on Vieques Island.

Eriphia quinquepunctata was described by Prof. Wm. T. M. Forbes (1931-360) from a type collected by him on Vieques Island, others from Coamo, a fuscous moth; "the scales with contrasting whitish bases and with whitish underscaling, so that the moth becomes steadily paler as it gets rubbed, and may become almost clay color." It has been collected at light at El Semil, Villalba, by Dr. W. A. Hoffman, in May 1940, and also on El Yunque.

Stilbosis phaeoptera was described by Prof. Wm. T. M. Forbes (1931-361), a "dark umber brown" moth, of which he collected the type from Coamo, another from El Yunque, and has a specimen from Surinam.

Aphanosara planistes was described by Prof. Wm. T. M. Forbes (1931-362), a whitish moth of which he collected the type from El Yunque, and painted the fore wing, see fig. 10 of his plate.

Blastobasidae

Blastobasis argillacea Walsingham, as identified by Prof. Forbes (1930-112) was collected by Mr. J. D. More as a brown scavenger caterpillar in cotton bolls injured by the pink bollworm, at Fajardo and between Guayama and Salinas on February 10, 1922, and reared by him to adult. It is a mottled moth, "with red-brown shading and contrasted fuscous scaling," as described by Prof. Forbes (1931-363) from material collected by Dr. W. A. Hoffman in Santurce, and by himself at Coamo and on Vieques Island.

Blastobasis subolivacea Walsingham, as determined by Prof. Forbes (1931-363), has "the fore tarsus as well as tibia fuscous, pale banded" in the specimens from Coamo; "more doubtful are a pair from Vieques Island, and a very dark specimen from Aguirre." It is "olive gray, shading to brownish outwardly; 12 mm.," according to Prof. Forbes (1930-112), who suspects "that a specimen bred from sorghum belongs to this species." Mr. Carl Heinrich has identified as a species of *Blastobasis* some moths which Messrs. R. G. Oakley, A. S. Mills and F. A. Vitrano reared from larvae intercepted on heads of grain sorghum being grown on the PRACO farm on Vieques Island, May 28, 1948. A previous identification of moths obtained from sorghum heads from Vieques Island a year and a half previously was *Holcocera* sp.

Auximobasis constans Walsingham was found by Prof. Forbes (1931-363) on Vieques Island, as was also *Auximobasis flaviciliata* Walsingham. "All my female material is *flaviciliata*, male *constans*, but Walsingham claims to have males of both."

Auximobasis insularis Walsingham was collected by Prof. Forbes (1931-0363) on Vieques Island.

Auximobasis variolata Walsingham was collected by Mr. Aug. Busck on Culebra Island in February 1899, and by Prof. Forbes (1931-363) on Vieques Island on April 1930, and at Coamo.

Prof. Forbes (1931-363) "cannot distinguish offhand from the North American *Pigritia ochrocomella*" moths collected by Dr. W. A. Hoffman at Palmas Abajo and by himself at Coamo and Lares.

Gelechiidae

Sitotroga cerealella (Olivier), the Angoumois grain moth, was first found in Puerto Rico by Dr. Richard T. Cotton in August 1917 attacking corn at Río Piedras. In November 1921 injury was widespread and serious to the grains of ripening corn at Vega Alta. The conditions under which it became so abundant as to attract notice can not be determined, for the insect is comparatively rare in Puerto Rico, and has been intercepted only once, resting on weeds at Cidra. Prof. Forbes (1930-116) describes

the moth as being "straw color, with obscure darker dots and shades; hind wing dark."

Œcia œcophila (Staudinger), as identified by Prof. Forbes (1930-115), was originally determined by Mr. Carl Heinrich as *Œcta maculata* Walsingham for Mr. J. D. More, who in January 1923 reared a single specimen from refuse in an "old cockroach jar." This is the only record for Puerto Rico.

Tholerostola evippella was described by Prof. Wm. T. M. Forbes (1931-364) from an abundance of material from Isabela, Coamo and San Germán, a "fuscous and cream white" moth, with a wing expanse of 7 mm.

Aristotelia absconditella (Walker) was collected by Prof. Forbes (1931-367) at Coamo.

Aristotelia diolcella was described by Prof. Wm. T. M. Forbes (1931-366) from an abundance of material collected by him on Vieques Island, others from Coamo, San Germán and Palmas Abajo, and mentioned by him as being from Puerto Rico in "The Rubidella Group of *Aristotelia* (Lepidoptera, Gelechiidae)" (Jour. N. Y. Ent. Soc., **40** (4): 423-433, pl. 1. New York, December 1932.). He has since identified it for Prof. J. A. Ramos (1947-51), who collected "several specimens at light, March 4, 1944, Sardinera Beach," Mona Island.

Aristotelia lignicolora was described by Prof. Wm. T. M. Forbes (1931-368) from a male collected by him at Coamo, mostly clay-colored, "characterized by an enormous penis."

Aristotelia penicillata Walsingham, originally described from Hispaniola, is identified by Prof. Forbes (1931-369) from his collections at Coamo and Isabela, which show "the '*Eucatoptus*' hair-pencil very strikingly." This moth is "ochreous with mottling and complex markings of grayish fuscous, whitish and some metallic gray; apex with some rosy; 10 mm."

Aristotelia picticornis Walsingham was collected by Prof. Forbes (1931-368) at Coamo.

Aristotelia vagabundella was described by Prof. Wm. T. M. Forbes (1931-365) from an abundance of material which he collected on Vieques Island, others from Isabela, Coamo and Aguirre.

Glaucacna iridea was described by Prof. Wm. T. M. Forbes (1931-369) from material which he collected on El Yunque, a dull ochre moth with a wing spread of 8 mm., of which his painting of the fore wing is fig. 15 of the colored plate.

Empedaula rhodocosma (Meyrick) was identified by Prof. Forbes (1931-370) from material he collected at Coamo and San Germán.

Prof. Forbes collected a specimen of *Eucordylea* at San Germán "in too poor condition to describe satisfactorily."

Epithectis annulicornis (Walsingham) was collected by Mr. Aug. Busck

on Culebra Island in February 1899, and by Prof. Forbes (1931-371) on Vieques Island in April 1930, and at Coamo Springs.

Epithectis eromene (Walsingham) is identified by Prof. Forbes (1931-370) from Santurce, Aguirre and Coamo, and a pale strain from Vieques Island. "Larva on *Bromelia pinguin*."

Epithectis kittella (Walsingham) "I think I recognize from El Yunque" writes Prof. Forbes (1931-371).

Schistophila fuscella was described by Prof. Wm. T. M. Forbes (1931-371) from a single type from El Yunque, mostly luteous or fuscous, with a wing spread of 11 mm.

Telphusa distictella was described by Prof. Wm. T. M. Forbes (1931-372) from a specimen collected at San Germán by Dr. M. D. Leonard, mostly "light dull gray" in color, with a wing spread of 10 mm."

Telphusa perspicua (Walsingham) was collected by Prof. Forbes (1931-372) on Vieques Island and at Coamo. It is "blackish-brown, contrastingly marked with yellow."

Trichotaphe (Cymotricha) pectinella was described by Prof. Wm. T. M. Forbes (1931-372) from a type he collected at Coamo which is "deep iron gray, with faint browny iridescence."

Trichotaphe (Onebala) elliptica was described by Prof. Wm. T. M. Forbes (1931-373) from a type which he collected on Vieques Island which is "ash gray," marked with contrasting cream yellow. The blackish fore wing is represented in fig. 19 of the colored plate.

Trichotaphe (Onebala) melissia (Walsingham) is identified by Prof. Forbes (1931-373) from Río Piedras and El Yunque. According to Mr. Aug. Busck, in Barbados its larva is a pest on sweet potatoes.

Trichotaphe manella was described as an *Ypsolophus* by Herr Heinrich B. Möschler (1890-344) from a single female collected in Puerto Rico by Dr. Gundlach, and listed by him. According to Prof. Forbes (1930-121), this moth is "dark violet, brown, with a costal yellow stripe, triangularly widened a third way out." It has been intercepted resting on pomarrosa at Barceloneta.

Mr. Aug. Busck identified as a new species of *Trichotaphe* a small grey moth with thick orange antennae, a large black spot near base of fore wings, which emerged from a pupa taken at Río Piedras in February 1923. He wrote that the "larva is a leaf-roller on *Inga vera* and is apt to be a fine, highly-colored larva."

Eunebristis zingarella (Walsingham), reared from round mines in the leaves of seagrape (*Coccoloba uvifera*) at San Juan in February 1899 by Mr. Aug. Busck was listed as a *Dichomeris* in "Insectae Portoricensis" (1923-202). It has since been reared from the same host at Mameyes, the adults having been identified by Prof. Forbes. Such mines are not es-

pecially common, but may locally occur in great abundance. The adult moth is "ochreous, mottled with brick red, with steel blue streaks and fringe; 9 mm.," according to Prof. Forbes (1930-120).

Dichomeris indignus (Walsingham) was collected by Prof. Forbes (1931-374) at Coamo and on El Yunque, and by Dr. W. A. Hoffman at Jájome Alto. It is "pale rufocinerous, somewhat mottled and powdery."

Dichomeris piperatus (Walsingham) was first noted in the spring of 1930 by Mr. L. A. Serrano at the Isabela Sub-Station, feeding on the tender leaves of alfalfa and webbing together the tips of the shoots. Mr. Francisco Seín reared some of these larvae to adult, had them identified by Prof. Forbes, who was in Puerto Rico at the time, and wrote "Insectos que atacan la Alfalfa en Puerto Rico" (Rev. Agr. P. R., **25** (2): 91. San Juan, 1930) and "*Dichomeris piperatus* Walsingham, a Pest of Alfalfa in Puerto Rico" (Jour. Ec. Ent., **23** (5): 885-6, Geneva, October, 1930). In subsequent years these caterpillars were much less abundant on alfalfa than in the first year that it was grown at Isabela, and indeed did little damage after this first attack. Presumably the caterpillars may feed on the leaves of other legumes, for Prof. Forbes (1930-121) notes collections of adults at Santurce, Cataño, and Coamo, and on Vieques Island, and they have been intercepted at light at Bayamón.

Dichomeris rusticus (Walsingham), as identified by Mr. Aug. Busck, has been intercepted at light at Bayamón. Dr. Stuart T. Danforth (1926-100) noted at the Cartagena Lagoon an unidentified species of *Dichomeris* eaten by the yellow-shouldered blackbird.

Thiotricha sciurella (Walsingham) was found by Prof. Forbes (1930-122) on Vieques Island. He describes the adult as being "silvery white; dark shades grayish; orange spot large, but not reaching dorsum; radiating orange and fuscous stripes in fringe below apex; 8 mm."

Polyhymno luteostrigella Chambers is "silvery white with longitudinal brown stripes, and oblique ones near the caudate apex; 9 mm.," according to Prof. Forbes (1930-123). It has been intercepted at light at Bayamón and Comerío and Prof. Forbes (1931-374) lists additional collections at Río Piedras, Cataño, Lares and Isabela, and by himself on Vieques Island.

Brachyacma palpigera (Walsingham) was found by Dr. M. D. Leonard and Mr. A. S. Mills, while collecting data for "A Preliminary Report on the Lima Bean Pod-Borer and other Legume Pod-Borers in Porto Rico" (Journ. Ec. Ent., **24** (2): 466-473. Geneva, April 1931), to occur in considerable abundance in dry pigeon pea pods grown along the north coast, or at Cabo Rojo. Often over half of these larvae were parasitized by *Paralitomastix* sp. nov., as determined by Mr. A. B. Gahan. They also found larvae in dry pods of *Crotalaria retusa* at Pueblo Viejo and Bayamón, and caterpillars have since been noted in old pods of *Crotalaria incana* at

Loíza Aldea, scavengers in pods previously occupied by larvae of *Etiella zinckenella*. The elongate, slender, whitish larvae are quite different in appearance from the plump greenish pod-borers which are primary in their attack on these hosts, and they transform to adults which Prof. Forbes (1930-123) describes as with "fore wing shading from pale ochreous to fawn brown, with a dark shade from middle of costa to apex, sometimes cut by two oblique white lines, and three dark dots on disc; 10–18 mm." Mr. H. K. Plank, in Reports of the Mayagüez Station (1937-74 and 1938-71), noted these caterpillars feeding on leaves of *Tephrosia candida* and *T. toxicaria*, and abundant in their pods during the summer. Adults have been taken at light at San Juan, and repeatedly at Bayamón, Prof. Forbes reporting (1931-374) collections made by him at Coamo and on Vieques Island.

Anacampsis (Commatica) bifuscella was described by Prof. Wm. T. M. Forbes (1931-375) from a type collected by him at Coamo, others from San Germán, Isabela and El Yunque. This is "a rather distinct little thing; ash gray, faintly yellowish and powdered lightly with fuscous scales."

Anacampsis (Anacampsis) insularis Walsingham was found by Prof. Forbes (1931-375) on El Yunque. The moth is "grayish fuscous, with three white costal blotches, the third nearly meeting a blotch on inner margin; a series of connected darker spots in fold, fringe whitish; 8 mm."

Two new but undescribed species of *Anacampsis* (*Anacampsis*) are listed by Prof. Forbes (1931-375), and Mr. Aug. Busck has thus identified adults reared from hibiscus buds intercepted at Vega Alta.

Anacampsis (Compsolechia) mangelivora Walsingham has a flesh-colored larva with brown head, which webs together two leaves of "mangle" (*Rhizophora mangle*). Prof. Forbes (1930-125) reports its collection on St. Thomas, and (1931-377) doubtfully reports its collection on El Yunque. No mangrove grows on El Yunque, but the adult of a caterpillar feeding on mangrove might be blown there from the mangrove swamps on the beach at Mameyes.

Anacampsis (Compsolechia) melanophaea was described by Prof. Wm. T. M. Forbes (1931-376, fig. 16) from a male from El Yunque (TYPE) and a duller colored female from Coamo, both collected by him.

Anacampsis (Compsolechia) meibomiella was described by Prof. Wm. T. M. Forbes (1931-376, fig. 17) from a light ash grey adult, reared from *Meibomia* in Cuba, and a "paler smoother looking, and more lightly marked" specimen from San Germán, Puerto Rico.

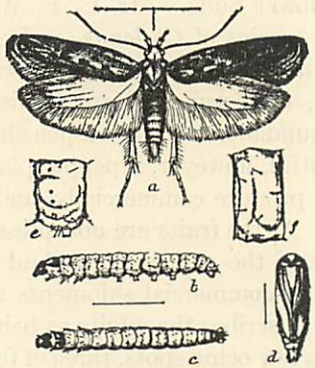
Anacampsis (Compsolechia) plumbeolata Walsingham is identified by Prof. Forbes (1931-377) from a non-typical specimen he collected at Coamo.

Gnorimoschema gudmannella (Walsingham), the pepper flower-bud moth, altho known from the Virgin Islands since before 1923, when Mr.

Charles E. Wilson reported it as one of the "Truck-Crop Insect Pests in the Virgin Islands" (Bulletin No. 4, Virgin Islands Agr. Expt. Station, pp. 35, fig. 24, Washington, D. C., 1923), was not noted in Puerto Rico until April 1940, when Mr. Francisco Seín found its larvae "abundant on buds and in flowers of cultivated pepper and 'ají' at Río Piedras," after specific inquiry by Mr. E. R. Sasscer if it might not be present here. His intensive studies were reported as "Oruga de la Flor del Pimiento" (*en* Informe Bienal, 1940-2, p. 91, Río Piedras, 1944). Its larvae are heavily parasitized, Mr. A. B. Gahan identifying as new a species of *Euderus* (Entedontidae) and a new species of *Copidosoma* (Encyrtidae), two of the parasites obtained. The latter is by far the most common and widely-distributed of the parasites, present at all seasons of the year everywhere that Mr. Seín collected the infested flower buds. Mr. C. F. W. Muesebeck identified two Braconid wasps; a species of *Chelonus*, and *Apanteles dignus*, which he had described from material reared from *Gnorimoschema lycopersicella* (Busck) at Santa Ana, California. Despite this heavy parasitism, the caterpillars are very abundant, and are responsible for a heavy drop of flower buds. It is doubtful, however, if pepper plants could develop more fruit than they actually produce commercially, and this heavy pruning of buds may be beneficial. As the fruits are not infested under Puerto Rican conditions, the presence of the pepper flower-bud moth does not involve quarantine restrictions on commercial shipments to continental markets. Prof. Forbes (1930-126) describes the adults as being "powdery gray, with white-tipped scales and a few ochre spots, three of four of them centered by a few black spots; costal pencil present in male; 8—10 mm."

Gnorimoschema operculella (Zeller), the potato tuberworm of continental United States, but in tobacco-growing regions known as a leaf-miner, or locally called "candela" or "candelilla," was not reported from Puerto Rico by Drs. Stahl or Gundlach, and indeed may not have been present here at the time they were collecting most intensively. As *Gelechia picipella*, it was reported by Mr. O. W. Barrett (1905-396) causing "slight damage to tobacco at Aguas Buenas." Under the older and more familiar generic name of *Phthorimaea*, Dr. Richard T. Cotton (1916-299) noted damage to eggplant, but this is quite exceptional. "Nuevas Cosechas, Nuevas Plagas" (Rev. Agr. P. R., **23** (2): 84–86. San Juan, 1929) is Mr. Francisco Seín's account of attack on Irish potatoes. Commercial injury in Puerto Rico is practically confined to tobacco, and this only during periods of more or less extended drought. The little greenish caterpillars feed on the interior layers of young tobacco leaves, the outer tissues becoming papery and yellowish-brown soon after the growing larva has extended its feeding to fresh areas. When fully-grown, the larva often becomes pinkish or purplish, pupating in trash or debris on the ground. The in-

conspicuous little brownish adult Prof. Forbes (1930-127) does not bother to describe. During the daytime it rests quietly on the ground or in debris, quickly seeking shelter if disturbed, but is doubtless active during the night, the females laying individual eggs on suitable hosts. Because the caterpillars feed on the inside of leaves, they are not susceptible to poisoning with arsenicals, but heavy rainfall quickly rots their burrows, exposing them to attack by predators and parasites and forcing them to eat poisoned tissue in starting a new mine. Indeed, all stages of the insect appear to be very susceptible to rainfall, and infestations drop to a minute fraction of 1% after heavy rains. Even under normal weather conditions infestations rarely become serious, but with continued scarcity of rain



The Tobacco Leaf-Miner or "Candela," *Gnorimoschema operculella* (Zeller): *a*, adult, *b* & *c*, larvae, *d*, pupa, *e*, *f*, segments of larva enlarged. (Redrawn from Riley and Howard, U. S. D. A.)

little may be left of young transplants except root, stem and midribs. If such weather were normal, tobacco growing would be possible only with overhead irrigation. The commercial tobacco regions, however, usually have ample rainfall to keep leaf-miner injury to a minimum, and it is the marginal regions, more subject to drought, where heaviest losses are most likely to occur. In the past, artificial control has been almost impossible, but the newer insecticides, especially DDT, may make control possible, even when climatic conditions are most unfavorable for the tobacco grower. This is a cosmopolitan pest, present everywhere in Puerto Rico except in the most humid regions, and Prof. Forbes (1931-377) records collection of adults at light by Dr. W. A. Hoffman at Jájome Alto, as well as by himself on Vieques Island.

Gnorimoschema striatella (Murtfeldt) is listed by Prof. Forbes (1930-127) as having been reared from "larva in berries of *Solanum*, pale green-

ish yellow with five irregular and interrupted crimson stripes, and shining dark brown head, true legs and cervical shield." Whether this refers to his record of collection at Fajardo, Jan. 19, 1914, is uncertain, but a subsequent record (1931-377) is of collection of adult at Cataño.

Gelechia exclarella was described by Herr Heinrich B. Möschler (1890-343) from a single specimen from Puerto Rico collected by Dr. Gundlach, and listed by him. It has not since been found anywhere.

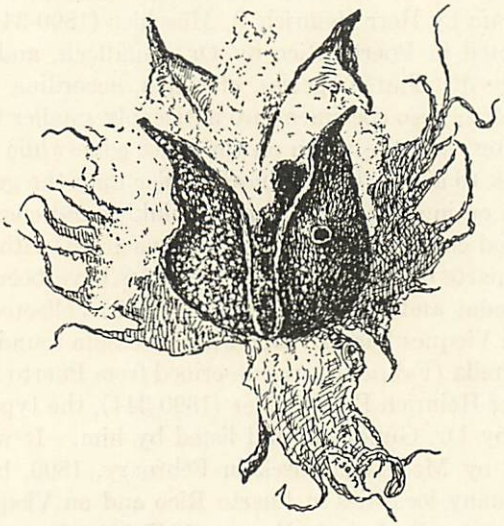
Gelechia salva Meyrick was collected by Prof. Forbes (1931-377) at Coamo and San Germán.

Stegasta bosquella (Chambers) var. **costipunctella** was described as a species of *Gelechia* by Herr Heinrich B. Möschler (1890-344) from a single specimen collected in Puerto Rico by Dr. Gundlach, and listed by him. This is a widely distributed species, of which, according to Prof. Forbes (1930-128), "Porto Rico specimens are noticeably smaller than those from the United States, and the patch on the inner edge while normal in form varies from pink to a dark brown, hardly paler than the ground. Purple-gray, the patch on inner margin tawny or pinkish and connected as a rule to the antemedial costal spot. 12 mm. Larva green, with crimson thorax and chitinized parts black; on *Cassia*." Adults have been intercepted at light at Bayamón, and Prof. Forbes (1931-377) collected them at San Germán and on Vieques Island. Mr. Francisco Seín found them at Lares.

Stegasta capitella (Fabricius) was described from Puerto Rico as *Gelechia rivulella* by Herr Heinrich B. Möschler (1890-344), the type a single specimen collected by Dr. Gundlach, and listed by him. It was collected on Culebra Island by Mr. Aug. Busck in February, 1899, by Prof. Forbes (1931-377) at many localities in Puerto Rico and on Vieques Island, and identified by him for Prof. J. A. Ramos (1947-51) who took specimens at light on Mona Island. It is "a common species, dark brown, spots and band on inner margin white; fringe mainly white; 8 mm. Walsingham believed that the type was taken on St. Croix," where recent collections have been made by Mr. Harry A. Beatty.

Pectinophora (or **Platyedra**) **gossypiella** (Saunders), the pink bollworm of cotton, was first found in Puerto Rico as an empty pupal case in an injured boll of tree cotton at Humacao, August 13, 1921, by Mr. Ignacio Torres. This was identified by Mr. J. D. More, and his identification confirmed by Mr. Carl Heinrich, but there was no question about the identity of the insect, and subsequent determinations were made by Mr. More as long as he remained in Puerto Rico. He examined all material collected on trips around the Island which showed that even in 1921, "The Distribution of the Pink Bollworm in Porto Rico" (Circular No. 85, Insular Expt. Station, pp. 7, map. San Juan, September 1923) extended from Cabo Rojo all along the south and east coasts as far as the Cabezas de San Juan, and along

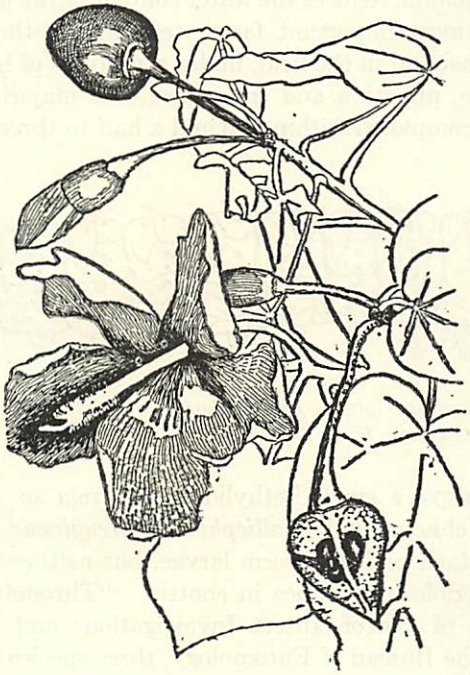
the north coast from Dorado to Aguadilla. This included all the principal cotton-growing areas of the Island, and spread in 1922 was not more than ten or fifteen miles from known areas of previous infestation, mostly to plants of wild or volunteer cotton. An anonymous report on the observations of Mr. Aug. Busck (Service and Regulatory Announcements, Federal Horticultural Board, July–December 1921, No. 71, pp. 95–178. Washington, D. C., 1922) indicated that the appearance of the pink bollworm in the Lesser Antilles was due to the importation of infested seed from Egypt into the Island of St. Croix in 1911–12, whence it reached Puerto Rico ten years



Exit Hole and typical Injury to Cotton Boll caused by the Pink Bollworm, *Pectinophora gossypiella* (Saunders). (Drawn by F. Seín.)

later. Due to the earlier appearance of the pink bollworm in the British Islands, the Puerto Rican cotton industry has enjoyed exceptional prosperity, growing Sea Island cotton for the manufacture of thread in England, and the discovery of this new and insidious pest demanded a strict enforcement of control measures if cotton growing was to be continued. Within the next ten years twenty-six publications dealing wholly or in part with this pest appeared, as listed in "Insectae Borinquenses" (1936-492 to 495), with attendant publicity that induced one local satirical columnist to sign his communications "Pink Bollworm." Mr. Juan Pastor Rodríguez wrote "Nuestra Industria Algodonera se ve Amenazada por un Insecto Peligroso" (El Imparcial Dominical, pp. 29–30, fig. 1. San Juan, May 23, 1937), and Mr. L. Courtney Fife, who had been sent to Puerto Rico to make ob-

servations exclusively on this insect, recorded the "Status of the Pink Bollworm in Puerto Rico during 1935–36" (Jour. Agr. Univ. P. R., **21** (2): 233–235. San Juan, July 1937). Seeds of the endemic "maga" (*Montezuma speciosissima*), an especially important cabinet-wood tree because its wood is more resistant to dry-wood termite attack than is mahogany, are often heavily infested by pink bollworm larvae after cotton has been harvested, and "The Infestation of Young Okra Pods by Pink Bollworm in Puerto Rico" (Jour. Dept. Agr. P. R., **15** (4): 395–398. San

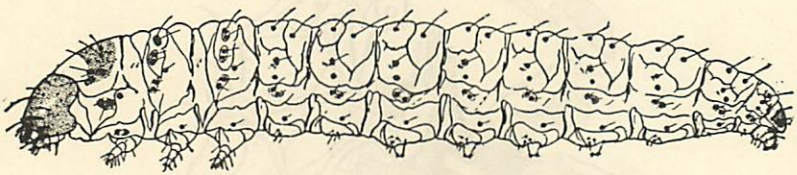


Infestation by the Pink Bollworm, *Pectinophora gossypiella* (Saunders), in the Seed Pods of Maga, *Montezuma speciosissima*. (Drawn by G. N. Wolcott.)

Juan, 1931) may indeed become total if grown near infested cotton. Mr. Fife's observations on "Alternate Host Plants of the Pink Bollworm in Puerto Rico" (Jour. Agr. Univ. P. R., **22** (4): 483–492, ref. 18. San Juan, March 23, 1939) gives additional data on this point.

"Studies of the Diapause in the Pink Bollworm in Puerto Rico" (Technical Bulletin No. 977, U. S. D. A., pp. 26, fig. 7, ref. 56. Washington, D. C., January 1949) by Mr. L. Courtney Fife showed that "under Puerto Rican conditions pink bollworms in the diapause always occur most abundantly during periods of drought, regardless of the age of the crop or

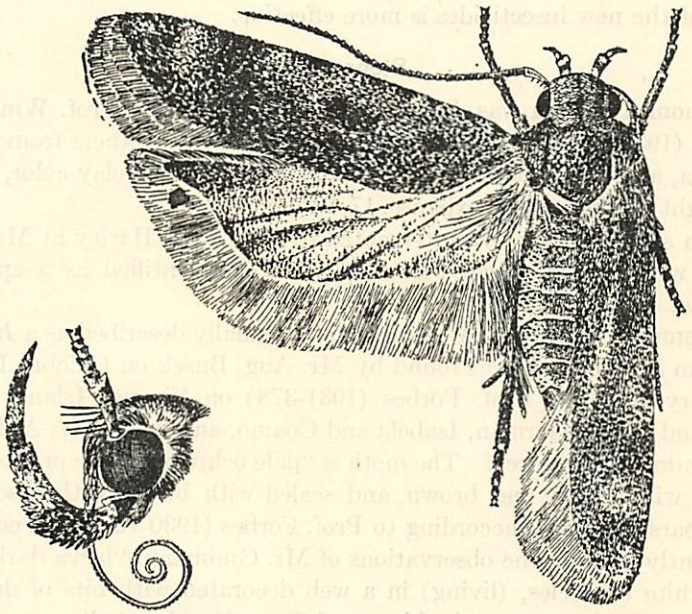
the time of the year at which the drought takes place. A few resting larvae always occur in the field regardless of the amount of rainfall—an indication of the existence of an inherited cycle which cannot be broken within several generations. A low relative humidity combined with a high temperature reduces the water content of the larvae by evaporation, thereby decreasing the rate of metabolism and causing arrested development. Dry food caused by drought conditions, i.e., lack of rainfall, high temperatures, low humidity, excessive wind movement, high evaporation, and lack of available moisture for the plants, reduces the water content of the larvae themselves. Moisture is the most important factor terminating the diapause under tropical conditions; and in the field, under conditions of heavy rainfall and high temperature, pupation and emergence of a majority of the resting larvae would be completed within two and a half to three months."



The Pink Bollworm of Cotton, *Pectinophora gossypiella* (Saunders), eight times natural size. (After Busck, U. S. D. A.)

Two native wasps, a small Bethylid (*Perisierola* sp. nov., near *nigrifemur*) and an Ichneumonid (*Calliephialtes ferrugineus* Cushman), have been found to attack pink bollworm larvae, but neither is abundant, and they are of negligible importance in control. "Through the cooperation of the Divisions of Cotton Insect Investigations and Foreign Parasite Introduction of the Bureau of Entomology, three species of pink bollworm parasites were introduced during 1935, 1936 and 1937, namely *Exeristes roborator*, *Microbracon kirkpatricki*, and *Chelonus blackburni*. These parasites were reared by L. W. Noble and W. T. Hunt at the Presidio, Texas, station of the Division of Cotton Insect Investigations, and were received and liberated by K. A. Bartlett of the Puerto Rico Station." Tens of thousands of these parasites were released and "Dr. Bartlett reports that all species were recovered at points of liberation within a few months after they were released," according to Mr. Fife (1939-4), but none was found in succeeding years. The completeness of the failure of natural control of the pink bollworm in Puerto Rico by means of parasites is matched by the inefficiency and ineffectiveness of the recommended agricultural practices and clean-up after the harvesting of the crop. Indeed, the later ob-

servations of Dr. Luis F. Martorell were to show that neither control measures nor alternate hosts were of such vital importance as propinquity to the ginnery at Isabela, which proved to be the major source of re-infestation for the succeeding crop. As the near-by farmers became aware of this, they ceased planting cotton, making impossible a continuation of observations on comparative infestation, but incidentally furnishing most convincing proof of its menace. Spraying the interior of the ginnery with 5% DDT in kerosene might have been effective in killing all emerging moths if



Adult and side view of head of adult of the Pink Bollworm, *Pectinophora gossypiella* (Saunders), ten times natural size. (After Busck, U. S. D. A.)

doors and windows had been kept closed, but as they had to be kept open for the reception of the crop and for the comfort of the workers, it was very largely nullified by the conditions under which the ginnery operated. To be sure, many pink bollworm moths, and possibly larvae and pupae, as well as various stages of numerous other insects, were killed by the single spraying of its interior August 31, 1945, but not in sufficient numbers to justify the adoption of such a procedure under any practical method of operation. A more modern ginnery, or its removal to outside of the cotton region, seems to be the most obvious remedy. The pink bollworm has been present on Mona Island quite as long as it has been in Puerto Rico, for the

light-house keeper took infested Egyptian seed from St. Croix there when such seed was first available, and the insect has survived on wild cotton to date. An intensive and costly wild cotton clean-up on Vieques Island, initiated just before World War II that Sea Island cotton might be grown there, may have been successful in eradicating pink bollworm, but no cotton was planted when the Navy and the PRACO took over the Island.

Most recent spraying tests conducted at Isabela indicate that commercial control of the pink bollworm can be obtained by spraying with DDT at two week intervals when squares begin to form. It is yet to be shown that any other of the new insecticides is more effective.

Stenomidae

Mothonica ocellea was described and illustrated by Prof. Wm. T. M. Forbes (1930-130 to 132), the type from Guatemala, others from Mexico, Panama, and Naguabo in Puerto Rico. The moth is "clay color, shading into light wood-brown; expanse 17–24 mm."

From seeds of *Inga vera* intercepted by Mr. A. G. Harley at Mayagüez, moths were reared which Mr. Carl Heinrich identified as a species of *Stenoma*.

Schistonoea fulvidella (Walsingham), originally described as a *Brachmia* (?) from St. Thomas, was found by Mr. Aug. Busck on Culebra Island in February 1899, by Prof. Forbes (1931-378) on Vieques Island in April 1930, and at San Germán, Isabela and Coamo, and by Dr. W. A. Hoffman at Dorado and Santurce. The moth is "pale ochreous, more or less heavily shaded with tawny and brown, and scaled with black; with fuscous terminal bars; 15 mm.," according to Prof. Forbes (1930-120), who continues, apparently quoting the observations of Mr. Gudmann, "larva dark brown, with white tubercles, (living) in a web decorated with bits of dead leaf, grass, etc., in the concave leaf-bases of *Bromelia pinguin*."

Ethmiidae

Ethmia abraxasella (Walker), first described as a *Psecadia* from Santo Domingo, was redescribed as *Psecadia aureoapicella* by Herr Heinrich B. Möschler (1890-341) from numerous specimens of both sexes collected in Puerto Rico by Dr. Gundlach, and listed by him. Mr. E. G. Smyth collected sixty-seven of these small speckled moths, as identified by Mr. Aug. Busck, at light at Hda. Santa Rita, Guánica during the latter half of 1913. In Van Zwaluwenburg's list it is PR 1403. Prof. Forbes (1930-134) notes additional collections at Coamo, and describes the moth as "white, with several black spots and brown shades on costa and a patch on inner margin; a golden dot nearly surrounded with black in middle of fold and another below apex on outer margin; hind wing translucent gray; 16 mm." Mr.

Francisco Seín took adults at light at Lares, but nothing is known as to the host plant of the larva.

Ethmia confusella (Walker) was re-described by Herr Heinrich B. Möschler (1890-343) as *Psecadia ingricella* from numerous specimens of both sexes collected in Puerto Rico by Dr. Gundlach, and listed by him. Mr. E. G. Smyth collected seventy-three of this "speckled gray" moth, as identified by Mr. Aug. Busck, at light at Hda. Santa Rita, Guánica, during the latter half of 1913, two-thirds of them taken in October. It is P. R. 1404 in Van Zwaluwenburg's list. It was taken by Mr. Aug. Busck on Culebra Island in February 1899, by Prof. Forbes (1931-379) on Vieques Island in April 1930, and noted by him as common at Coamo and San Germán. Altho the moth appears grey, it is really white with numerous black dots and dashes on the body and fore wings; the hind wings translucent white; expanse 20 mm.

Ethmia joviella Walsingham was collected at Río Piedras by Dr. M. D. Leonard, and at Isabela by Prof. Forbes (1931-379), who describes it as being "smaller than the other Puerto Rican species; white, fore wing with about eight black dots; hind wing gray with white fringe; 14 mm."

Ethmia kirbyi was described as a *Psecadia* by Herr Heinrich B. Möschler (1890-342) from a pair collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930-133) collected several at Coamo which he described as "white with numerous gray spots, fusing into costal and dorsal marginal stripes towards apex; marginal stripe golden in male, absent in female; 16 mm."

Ethmia notatella (Walker), listed as *Psecadia xanthorrhoa* Zeller from Puerto Rico by Herr Möschler and Dr. Gundlach, was identified under this specific name by Mr. Aug. Busck for Mr. E. G. Smyth, who collected forty-five of this "speckled white" moth at light at Hda. Santa Rita, Guánica, during the latter half of 1913. It is *Ethmia xanthorrhoa* Zeller, P. R. 1405 in Van Zwaluwenburg's list. Prof. Forbes notes collection at Coamo (1930-133) and at Curaçao, and in Hispaniola. Dr. Luis F. Martorell collected many adults at light on Mona Island, both at the lighthouse and at Camp Kofresí, and Prof. J. A. Ramos (1947-51) also found it abundant. This striking moth has a wing expanse of 25 mm., black eyes, its white thorax and fore wings spotted with black; hind wings translucent grey, darker at apex, fringed with white; abdomen grey.

Ethmia nivosella (Walker) was first listed from Puerto Rico by Herr Möschler and Dr. Gundlach as *Psecadia adustella* Zeller, and this specific name was given by Mr. Aug. Busck to Mr. E. G. Smyth, who collected fifty-five of these "brown and white" moths at light at Hda. Santa Rita, Guánica, during the latter half of 1913. In Van Zwaluwenburg's list it is P. R. 1402, *Ethmia adustella* Zeller. Adults have been intercepted at

Bayamón. They have a dense tuft of erect white hair on their head; body, base of fore wing and very large dorsal patch dark brown, with traces of purplish iridescence; outlines of these spots, costal and apical margins and hind wings grey.

Coleophoridae

Coleophora picticornis Walsingham, as identified with some doubt by Mr. J. F. Gates Clarke, was collected at light by Dr. W. A. Hoffman at El Semil, Villalba, May 10, 1940.

Coleophora pulchricornis Walsingham was collected by Prof. Forbes (1930-138) at Coamo and on Vieques Island. He describes the adult as being "dull fawn, with a whitish costal streak and some streaks on veins outwardly; a black and white streak below costa and a small streak or two small streaks towards apex, 10 mm. Larva in a straight case ("cigar-case"), with mouth set on at an angle and with a three-keeled apex." While making observations on "The Minor Sugar-Cane Insects of Porto Rico" (Jour. Dept. Agr. P. R., **5** (2): 5–47, fig. 19. San Juan, April 1921), "a large number of case-bearer larvae and pupae (identified by Mr. Aug. Busck as a species of *Coleophora*) were noted on cane plants 12–24 inches high, May 13, 1920, in a field on a shelf of the Espinosa hill road from the Toa Valley. No indication of their feeding on cane was observed, but some plants had as many as eight on a single shoot. A few specimens had previously been found on cane, farther down the valley at Toa Baja and Dorado, from which parasites emerged determined by Mr. A. B. Gahan as a species of *Microplectrum*."

Gracilariidae

Spanioptila spinosum Walsingham was found by Prof. Forbes (1931-380) at Coamo. It is "white, with some transverse dark flecking and faint yellowish shades; a dark streak in apical fringe; 10 mm."

In the Mayagüez Station Report for 1939 (1940-115), a leaf-miner in the leaves of *Tephrosia* spp. is noted, identified by Mr. Aug. Busck as a new species of *Phyllonorycter*.

Acrocercops albomarginata (Walsingham) was found by Prof. Forbes (1930-142) at Coamo.

Acrocercops cymella is described and illustrated (his fig. 23 of the colored plate) by Prof. Wm. T. M. Forbes (1930-380) from a type he collected at Coamo. It is "a striking species; fore wing white, marked with shining fuscous gray; 13 mm."

Acrocercops dives (Walsingham), as identified by Prof. Forbes (1930-141), was collected at Mayagüez by Mr. R. H. Van Zwaluwenbürg. It is "brilliant metallic bronze; forewing with an orange patch on costa contain-

ing a black and bronze costal spot before middle, and one at end of cell, beyond which the wing is duller golden; base of costa black, 8 mm." Mr. Francisco Seín reared the larvae, which are blotch-miners, from the leaves of *Inga vera* at Lares, in October 1936. Mr. Aug. Busck determined the reared adults, and Mr. C. F. W. Muesebeck identified a parasite as a new species of *Microbracon*.

Acrocercops inconspicua was described by Prof. Wm. T. M. Forbes (1930-142) from a type reared from larvae mining in the leaves of "péndula" (*Citharexylon fruticosum*) at Yauco in January 1923. It is a minute moth, with a wing spread of only 5 mm., "gray with black spots."

Acrocercops pontifica was described and illustrated (fig. 24 of his colored plate) by Prof. Wm. T. M. Forbes (1931-380), the type from El Yunque, "ochre yellow, marked with silver."

Acrocercops rendalli (Walsingham), originally described from Jamaica, is with some doubt identified by Prof. Forbes (1930-142) as being the moth reared by Mr. Thos. H. Jones from larvae mining in the leaves of a Malvaceous weed at Río Piedras. The adult is "buff, transversely banded with silver, antemedial and medial band very broad, postmedial narrow, and apex again white." It has recently been reared by Prof. James G-. Needham at Río Piedras from larvae mining the leaves of hibiscus.

Acrocercops sanctæcrucis (Walsingham) was originally described from St. Croix, as is indicated by the specific name, but is not noted as a pest of eggplant by Mr. Charles E. Wilson (1923-21), nor even listed by Mr. Harry A. Beatty in his "Fauna of St. Croix, V. I." (Jour. Agr. Univ. P. R., **28** (3–4, July–October, 1944): 103–185. Río Piedras, July 7, 1947). The reddish larvae, making linear mines at first in the leaves of eggplant, and later blotch mines with characteristic puckering of the uneaten leaf around the mine, were first noted in Puerto Rico by Dr. Richard T. Cotton at Río Piedras in the spring of 1916. He reared adults which were identified by Mr. Aug. Busck, but his account (1918-300) of this pest gives little indication of how serious it may at times become, for he says "the parasites of this insect are very abundant and keep it well under control at all times." Indeed, the insect is so small that one can hardly think of it as being much of a pest, yet when several caterpillars occur in the first, full-sized leaf put out by the young seedling, nearly all of its surface may be invaded. If conditions are favorable for the continued growth of the plants, no perceptible injury results, but in seed-beds not kept watered and thinned, many seedlings die, presumably in part at least because of this leaf-miner. Rarely are mines to be noted on the leaves of older plants, and injury, except in the seed-bed, is negligible. No method of artificial control has been tested, but presumably nicotine sulfate would be effective, and most certainly DDT and some of the newer insecticides. The heavy infestation

recorded was at Isabela in January 1932, but mines have also been noted in *Solanum torvum* at Río Piedras. Prof. Forbes (1931-380) lists collections of adults at Coamo and Las Cruces (Cidra), adding, "Mr. Busck tells me that *A. undifraga* Meyrick, from Haiti, bred from *Solanum torvum*, is a synonym of this species." The adult is a beautiful little moth, the wings of which are dark brown with four silvery spots, two of which are triangular, edged with black (making a cross across the back—another explanation of the specific name), and when at rest are kept tightly folded around the abdomen. The little moth seems to have disproportionately large legs and antennae, and it fearlessly stands up on its hind legs at a sharp angle quite different in manner from the clinging, crouching habits of many insects.

Acrocercops zebrulella was described and illustrated (figs. 21 and 22 of his colored plate) by Prof. Wm. T. M. Forbes (1931-381) from types and paratypes collected by him on El Yunque. It is "a striking little thing," its fore wing white and light buff or yellow with pattern in dull black.

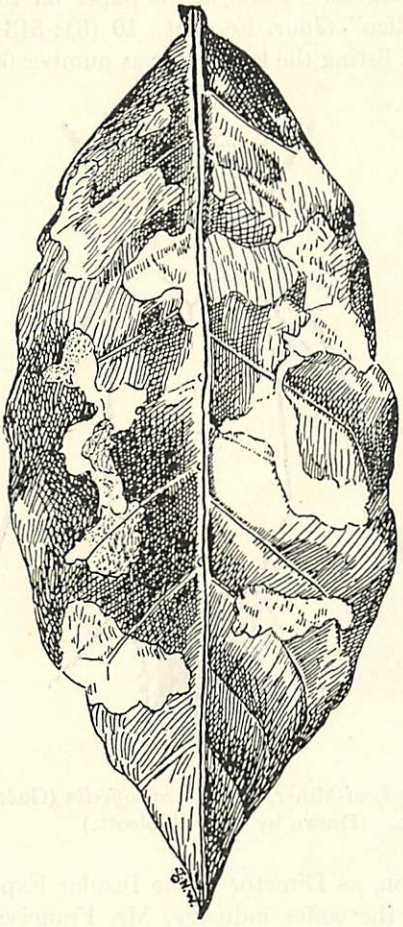
Prof. Forbes (1931-382) notes "three more species of *Acrocercops* from Porto Rico not suitable for description." He suspects another, "with grey-barred borders," reared from the smaller mines in the leaves of seagrape (*Coccoloba uvifera*) at Mameyes in February 1936, as being new. Mr. J. F. Gates Clarke gave no specific identification to the moths of this genus which Dr. Luis F. Martorell reared in 1940 from material collected from "escambrón colorado" (*Pithecellobium unguis-cati*) on the Cayey-Salinas road, and later in the year from "capá prieto" (*Cerdana alliodora*), in the same region.

Gracilaria aeneocapitella Walsingham, originally described from the Island of St. Vincent, Prof. Forbes (1931-382) has identified from Lares. The adults he describes as being "tawny, the costa except at base golden yellow, with purple iridescence and dark brown flecking, especially on costa and towards apex."

Lyonetiidae

Mr. Aug. Busck identified as a species of *Bucculatrix* the moths which Dr. Luis F. Martorell (1948-135) reared from very numerous small caterpillars feeding on the leaves of "ceiba" (*Ceiba pentandra*) north of Aguadilla, in October, 1940, causing an incomplete but heavy defoliation. Each caterpillar was under a white silken net, feeding on the leaf surface, sometimes breaking thru and making a hole in the leaf. When fully-grown the caterpillar spun a light grey, ribbed cocoon attached to the midrib of the leaf, from which the adult emerged leaving the empty pupa case half out of the entrance.

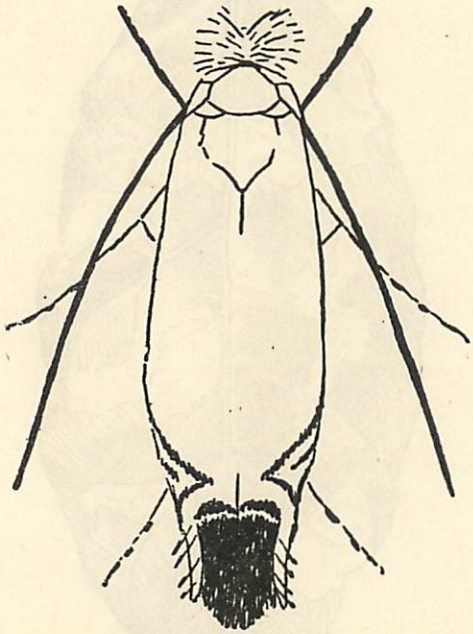
Leucoptera coffeella (Guérin-Méneville), the cosmopolitan coffee leaf-miner, was not noted in Puerto Rico by Drs. Gundlach or Stahl, the first record for the Island being by Mr. O. W. Barrett, in his first report as Entomologist and Botanist (*in* Ann. Report P. R. Agr. Expt. Station for



Injury to Coffee Leaf by the Miner Caterpillars of *Leucoptera coffeella* (Guérin-Méneville). (Drawn by G. N. Wolcott.)

1903, pp. 429–450. Washington, D. C., 1904). By the next year (1905-397) he had discovered that its caterpillars were parasitized by the minute wasp *Chrysocharis livida* Ashmead, and by the following year (1906-22) had reared another parasite, *Zagrammosoma multilineata* Ashmead. The

Coffee Specialist at the Mayagüez Station, Mr. J. W. Van Leenhoff, reported (1906-46) that severe attacks caused shedding of the leaves, and Dr. C. W. Hooker (1913-14) noted abundance of the caterpillars. Mr. R. H. Van Zwaluwenburg made intensive studies, as reported from year to year, summarizing the results in his paper on the "Insects Affecting Coffee in Puerto Rico" (Jour. Ec. Ent., **10** (6): 513–517. Concord, December, 1917), and listing the leaf-miner as number 602 in his list. When



Adult of the Coffee Leaf-Miner, *Leucoptera coffeella* (Guérin-Méneville), twenty-five times natural size. (Drawn by G. N. Wolcott.)

Mr. Edmundo Colón, as Director of the Insular Experiment Station, initiated a survey of the coffee industry, Mr. Francisco Seín eagerly commenced studies which were continued almost up to the present, but of which the results were for the most part reported by others in one or two paragraphs in each annual report of the Insular Station. The preliminary Circular No. 52 (pp. 12, fig. 6. Insular Experiment Station, Río Piedras, October 1921) attempted to summarize all that was known of "El Minador de las Hojas del Café." In "An Economic Entomology of the West Indies" (1933-330 to 338) is an extensive, illustrated account. Mr. Seín went to Haiti to discover why the leaf-miner was so scarce there, and later

visiting some of the Lesser Antilles, discovered in Guadaloupe the parasite, which Mr. C. F. W. Muesebeck named *Mirax insularis*, which attacks from sixty to eighty-five per cent of all the leaf-miner caterpillars. Introduced into Puerto Rico, it managed to survive at Lares, but only in one recent exceptionally dry year has it become as abundant as the native parasites. Mr. Seín found that these native parasites are not as common in the principal coffee regions as Mr. Barrett found them at Mayagüez, and that their combined effect in natural control is negligible. The important factor is humidity: ridges exposed to the full force of the drying wind having heavy infestations, while protected humid ravines a short distance away have trees practically free from mines. Artificial control in seed-beds can be obtained by spraying with nicotine sulfate, but this is hardly practical after the trees have been set out in their permanent position in the grove. The only host of the leaf-miner is Arabian coffee, and everywhere in the Island that host trees are present, infestation by the leaf-miner will be noted. The adult is a little satiny-white moth, its forewings outwardly margined with a darker pattern, its head with a spreading tuft of white hairs. Mr. Seín made numerous paintings, but no comparable, carefully-worked out drawings that could be reproduced in black and white. The moth shows a strong "A Reaction to Light Intensity" (Ecology, **3** (1): 86. Brooklyn, January 1922) as do the caterpillars when they chose a place in which to spin their cocoons. All observed ecological relations to environment and parasites are given in "A Quintessence of Sensitivity: The Coffee Leaf-Miner" (Jour. Agr. Univ. P.R., **31** (3-July 1947): 215–219. Río Piedras, Sept. 19, 1950).

Oinophilidae

Taeniodictys sericella was described by Prof. Wm. T. M. Forbes as one of "Two Wasp-Guests from Puerto Rico (Microlepidoptera)" (Psyche, **40** (3): 89–91. Pl. 1. Cambridge, September 1933), the type reared by Mr. Francisco Seín from nests of *Polistes crinitus* at Lares.

Mr. Aug. Busck has identified as a species of *Opogona* the moths reared from larvae which are scavengers in old leaves of coconut palm previously infested with *Homaledra sabalella* (Chambers). Prof. Forbes (1930-148) thinks that "it is closely related to *O. rhynchacma* Meyrick, of Brazil, but appears to be distinct." The Puerto Rican sugar-cane bud moth, the same or another species of *Opogona*, develops from "a small grey-brown caterpillar with a black head, which eats the eyes of cane and makes superficial tunnels in the rind of the cane stalk near the nodes, and in the inside of the leaf-sheaths, when burrowing between the stalk and the leaf-sheaths. During 1914–16, in examining a large number of fully-grown stalks of cane in all parts of the Island, it was found to have made tunnels or eaten into

the eyes of 1.2 per cent of all stalks examined. It can not be considered a pest of very great importance, as it does not burrow far enough into the rind of the cane to cause an appreciable loss of juice, and the eyes chewed into are usually far enough down on the stalk so that they go to the mill to be ground and are not on the seed-top. It is also so scarce that it would not be noted unless large numbers of stalks are inspected."

Tischeriidae

Tischeria heliopsisella Chambers is Prof. Forbes' re-determination (1930-150) of the moths which Mr. Thos. H. Jones reared from leaf-miners in *Piper?* sp., found on El Yunque in December 1912. The adult has a "fore wing with two transverse bands of fuscous dusting."

Psychidae

Oiketicus kirbyi Guilding, the West Indian bagworm, presumably originally described from Jamaica, was first listed from Puerto Rico by Herr Möschler (1890-122)—a single male in the collection of Dr. Staudinger, not seen by Dr. Gundlach—and from Cuba, "Raupe auf Persea gratissima, Cupania, Terminalia u.s.w." The larva of this bagworm is an omnivorous feeder, Dr. Luis F. Martorell (1948-545) listing over a dozen additional trees on which it is recorded or he found it feeding, and this does not include the introduced ash trees (*Fraxinus*, sp.) on which it was noted at Cayey and Maricao, or leafless trees that could not be identified in the Guánica Forest. Indeed, it rather appears to prefer introduced trees, for it was noted on beefwood (*Casuarina equisetifolia*) at Arecibo, Guánica and on Mona Island, and for several years was very abundant on "ciprés" (*Thuja orientalis*) around the lily pool at the Forest Station, Río Piedras. The lizards *Anolis pulchellus* and *Anolis cristatellus* swallow the larva inside its bag, and are apparently able to sever its connection with the host twig. Presumably the bag, and the bits of leaf, twig and other vegetable debris adorning its exterior, are undigestible, but it hardly seems possible that lizards would eat enough of these bagworms to eliminate an infestation, yet no other natural enemy is known. Dispersion to fresh hosts is difficult, for the female is a naked maggot "that never leaves the cocoon. The male of the Porto Rican species has an enormous extensible abdomen with which to fertilize her," according to Prof. Forbes (1930–150). He is of the opinion that dispersion occurs among the young larvae which drift with the wind immediately after hatching.

Tineidae

Ereunetis aeneoalbida Walsingham was collected at Aguirre by Dr. M. D. Leonard and at San Germán by Prof. Forbes (1931-382). He

(1930-148) describes it as having "antennae yellowish, vertex brassy; three costal brassy streaks and one dorsal on fore wing; 8 mm., snow white, with two fasciae near base, and oblique ones toward apex, and a longitudinal black line."

Ereunetis minuscula Walsingham, as determined by Mr. Aug. Busck, was reared by Mr. Thos. H. Jones from larvae "working under scales on papaya" at Río Piedras in November 1912; by Dr. Richard T. Cotton from larvae "feeding on purple scale in citrus grove" at Río Piedras in January 1917, and by Dr. M. D. Leonard (1932-1106) feeding on cottony cushion scale. Mr. Busck wrote to Dr. Cotton that "this species is a very general feeder, and one of the most abundant Micros in the West Indies and Florida. It has been bred from scale insects before, but I doubt that it is really predaceous on the scale; it is more likely merely a scavenger, which incidentally eats the living scale. I have bred the species in large numbers in Cuba from refuse in a coconut warehouse, and from dry "mummy" fruit of loquats in Florida." When the survey was being made of the dispersion of pink bollworm, it was repeatedly found as a scavenger in injured cotton bolls, Mr. J. D. More rearing adults, as determined by Mr. Carl Heinrich, from collections at Mameyes, Humacao and Fortuna (Ponce). Larvae have been found in old cotton lint at Vega Baja, in dry okra pod at Vega Baja, in partitions of pods of *Thespesia populnea* at Guayanilla, in old coconut palm leaves at Río Piedras, and intercepted in cowpeas on Vieques Island. Adults have been repeatedly intercepted at light at Bayamón. Prof. Forbes (1930-147) describes the moth as being "light wood color, with oblique darker bands; base of male hind wing transparent."

Ereunetis particolor Walsingham, as identified by Mr. Aug. Busck, was collected at Río Piedras in January 1923 by Mr. J. D. More, a single specimen resting on a pink bollworm rearing box.

Setomorpha insectella (Fabricius), as identified by Mr. Aug. Busck, was first noted in Puerto Rico by Mr. D. L. Van Dine, who found the larvae developing on paprika at Río Piedras in May 1912. Mr. Francisco Seín later thought them to be scavengers in the abandoned nests of paper wasps, and Prof. Forbes (1930-152) notes that "The larva is a tropical and warm-temperate pest in stored food, and is especially injurious to potatoes," altho not so recorded in Puerto Rico. The adult he describes, as "dull luteous, spotted with gray," repeatedly intercepted at light at Bayamón.

Tiquadra aeneonivella (Walker) was first listed from Puerto Rico by Herr Möschler (1890-338) as *Tiquadra aspera* Zeller, identifying several specimens for Dr. Gundlach. "Nach Berg, lebt die Raupe in einem langlich ovalen Sack." A large grey moth reared from a pupa found in a rotten

Erythrina tree at Cayey in November 1922 was identified as *Tiquadra inscitella* Walker by Mr. Aug. Busck, but is re-determined by Prof. Forbes (1930-152), who thinks "The Porto Rican species may well be new." The male he describes as "cream-colored, with numerous light grey spots; female much larger, pearl gray with larger, darker gray spots. Hind wing of male whitish with a pale brassy lustre; that of female gray. 25–35 mm."

The moth reared from a creamy white, unmarked caterpillar living in a dead and rotten underground stem of sugar-cane at Río Piedras in January 1915, was identified by Mr. Aug. Busck as a species of *Amydria*, possibly his *umbraticella* (Proc. U. S. National Museum, **47:** 64. Washington, D. C., 1914).

Myrmecozela ochraceella Tengström, reported from Puerto Rico by Herr Möschler and Dr. Gundlach, Prof. Forbes (1930-154) considers "undoubtedly an accidental introduction from Europe." It has not since been found locally.

Achanodes antipathetica was described by Prof. Wm. T. M. Forbes (1931-384) from a type male collected by Dr. W. A. Hoffman at Santurce, others from San Germán, Isabela, Coamo, Dorado, San Juan and the Island of Vieques, with light and dark forms, "dull ochre to light wood brown, more or less dusted with fuscous; 9 mm." Don Julio García-Díaz (1938-96) also collected this moth when making his survey of fresh water insects.

Antipolistes anthracella was described by Prof. Wm. T. M. Forbes (1933-92) from type material from Lares reared by Mr. Francisco Seín from nests of the paper wasp, *Polistes crinitus* Felton.

Tineola walsinghami, the plaster bagworm, was described by Mr. Aug. Busck on page 188 of his "Microlepidoptera of Cuba" (Entomologica Americana of Brooklyn Ent. Soc. **13** (4): 151–202, pl. 7. Lancaster, 1933), the type from St. Thomas, but present generally in the West Indies and southern Florida. *Tineola uterella* Walsingham, originally described from Brasil, is considered by Mr. Busck to be distinct from the West Indian species, altho most of the references are under that name, and indeed the original identification from Puerto Rico as such was by Mr. Busck. Not especially abundant in wooden houses, the flattened cases of this bagworm appear in surprisingly large numbers on the walls of freshly finished concrete buildings, with grains of sand and flecks of cement attached to the outside of the silken bag. What the caterpillar inside can find to eat is a mystery to many people, for most housekeepers feel sure that not enough dead insects, spider skins and other debris can possibly occur on new walls to support such a population of bagworms. In this they are quite correct, for woolen clothes in storage and especially woolen blankets when not in constant use are attacked, as may be noted in the Forest Service camps on

El Yunque, at El Verde, and at Camp Kofresí on Mona Island. Even cotton clothes may have holes eaten in them at times, for the bagworms hide in wicker laundry hampers, and in wardrobes which can not be closed tightly enough to exclude them, or are carelessly left open. Prof. J. R. Watson considers what he named "the plaster bagworm" a most serious pest of woolen rugs, and in Florida Press Bulletin No. 536 (pp. 2. Gainesville, 1939) recommends control by means of fresh pyrethrum powder, or soaking or spraying the rugs with a solution of pyrethrum in water-white kerosene. *Tineola biselliella* (Hummel), the webbing clothes moth, and *Tinea pellionella* (L.), the casemaking clothes moth, may be temporarily present in Puerto Rico by introduction, but neither has been identified from local collecting. *Apanteles carpatus* Say, the common parasite of the continental clothes moths, is however, present in Puerto Rico and presumably attacks the plaster bagworm. The crested lizard, *Anolis cristatellus*, when living in the house, may swallow the insect, bag and all, as it hitches its way along. Dr. Stuart T. Danforth (1926-122) reports finding this bagworm eaten by the northern water thrush, but presumably this is of rare occurrence. The rarely noted adult, as described by Prof. Forbes (1930-154), is "yellowish fawn, with some purplish fuscous dusting, and a few purplish fuscous spots; 10–15 mm."

Tinea brevistrigata Walsingham was collected on Culebra Island in February 1899 by Mr. Aug. Busck, in April 1930 by Prof. Forbes (1931-388) on Vieques Island, and by Dr. M. D. Leonard and Mr. A. S. Mills at Aguirre. It has the "dorsal half of wing grayer than costa; four dark brownish fuscous streaks, two in fold and two in cell; 9–12 mm."

Tinea familiaris Zeller was found by Prof. Forbes (1931-388) at Coamo and on Vieques Island. He had previously (1930-159) reported it from St. Thomas "taken in a house, and perhaps a clothes-moth in habits."

Tinea minutella (Fabricius) originally described from "Americae insulis" —"not improbably St. Thomas" according to Prof. Forbes (1930-158), has been identified by Mr. Aug. Busck from Puerto Rico for Mr. A. S. Mills who reared an adult from a pupa intercepted on grapefruit at Bayamón. Concerning it, Mr. Busck wrote that it was "a most interesting, striking species which has never been re-discovered since Fabricius' description. No specimen in the British Museum, here (U. S. National Museum), or in Cornell before this." It is a white moth, more or less dusted with gray, both antennae and palpi white; a wing expanse of 9 mm.

Tinea pallidorsella Zeller was found by Prof. Forbes (1931-388) on El Yunque, April 22, 1930. "The ground is wood brown, and in our fresh specimen the dark flecks show a distinct violet iridescence."

Tinea scythropiella Walsingham was collected by Prof. Forbes (1931-388) on Vieques Island and on El Yunque, by Dr. W. A. Hoffman at Palmas

Abajo (between Guayama and Jájome Alto), and at Cataño. It is white, "lightly dusted with brown; an antemedial oblique brown dash from costa, an angulated median band, a spot at end of cell and smaller ones outwardly; 11 mm."

Homostinea tischeriella (Walsingham) was collected by Prof. Forbes (1931-385) on El Yunque, a brown and ochreous species with "a purplish iridescence on the dark part of the fore wing." He identified for Don Julio García-Díaz (1938-96) others that had been collected in his survey of fresh water insects.

Infurcitinea palpella was described by Prof. Wm. T. M. Forbes (1931-386) from material he collected on Vieques Island, others from Cataño, "dark clay color or light wood brown, dusted and marked with grayish fuscous; 8 mm."

Infurcitinea luteella was described by Prof. Wm. T. M. Forbes (1931-386) from moths collected by him on Vieques Island, "luteous, dusted with fuscous, 8 mm."

Mea incudella was described and illustrated (fig. 26 of his colored plate) by Prof. Wm. T. M. Forbes (1931-387) from specimens collected by him on El Yunque, others from Santurce taken by Dr. W. A. Hoffman, "white with black markings; 9 mm."

Mea yunquella was described and illustrated (fig. 25 of his colored plate) by Prof. Wm. T. M. Forbes (1931-388) from a single type found by him "flying about the face of a cliff near the summit of El Yunque; cream color or bone white, marked with black, larger and heavier (than the preceding species), the hind wing wider with more sinuate costa; 10 mm."

Small silvery moths which Mr. Aug. Busck identified as a new species of *Mea* were reared from larvae making long tunnels of silk, in which the excrement was entangled, over bark of trees of *Inga vera* infested by *Xyleborus* beetles at Juana Díaz. The tunnels were of so solid a construction they could be lifted off whole.

Protodarcia argyrophaea was described and illustrated (fig. 28 of his colored plate) by Prof. Wm. T. M. Forbes (1931-390) from moths collected by him at Coamo. It is "a striking species; fore wing light gray-brown, with irregular silvery white transverse lines; 7 mm."

Protodarcia bicolorella was described and illustrated (fig. 27 of his colored plate) by Prof. Wm. T. M. Forbes (1931-389), the type from Coamo, others from Vieques Island, Río Piedras and San Germán. It is "a striking little thing; fore wing dark gray, mottled with black and outwardly with white; 7 mm."

Protodarcia plumella (Walsingham), originally described as a *Tinea* from St. Croix, was collected by Dr. M. D. Leonard at San Germán, as identified by Prof. Forbes (1931-390). Its "fore wing (is) tricolored, with black and ferruginous on white; antenna gray; 6 mm."

Pexicnemidia mirella was described as a new genus and new species by Herr Heinrich B. Möschler (1890-338) from two males collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930-159) re-describes it as "fuscous with paler hind wing; immaculate; 14 mm." It has not since been found anywhere.

Acrolophus (Pseudanaphora) arcanellus (Clemens) was re-described by Prof. Forbes (1931-390) examining a small specimen intercepted by Mr. A. S. Mills at Río Piedras. It has also been collected at light at Utuado by Dr. W. A. Hoffman, as identified by Mr. Aug. Busck.

The moth collected at Aguirre by Dr. M. D. Leonard on May 22, 1930, was identified by Prof. Forbes (1931-391) as a new species of *Pseudanaphora*.

Acrolophus (Caenogenes) ochraceus was described as *? Caenogenes* by Herr Heinrich B. Möschler (1890-337) from a single male collected in Puerto Rico by Dr. Gundlach, and listed by him. Prof. Forbes (1930-162) re-described specimens from Coamo as being "light ochre, dusted with red-brown, with three powdery dark brown spots; 20 mm.," and later (1931-393) notes additional collections at Río Piedras, Santurce and Cataño.

Acrolophus (Anaphora) popeanellus Clemens is listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but Prof. Forbes (1930-162) thinks "this record should be verified."

Acrolophus (Anaphora) triformellus was described by Prof. Wm. T. M. Forbes (1930-163), the type from Coamo, others from Manatí, Mayagüez, and Hda. Santa Rita, Guánica. "This appears to be the commonest species of *Acrolophus* in Porto Rico. *A. walsinghami* Möschler—should be rather similar, but the latter is described by Möschler as "brick-red," and he later notes (1931-391) "a series of this species from San Germán tend strongly to a reddish ground, and may turn out to be *walsinghami* Möschler." Mr. E. G. Smyth collected only ten paratypes of this moth at Hda. Santa Rita, Guánica in 1913, eight of these being taken in August, but the following spring he reared several more from dirty brown larvae which he found spinning silken tunnels among trash on the ground. He was doubtful as to the host, but presumably this species was the one of which caterpillars were so numerous at Juncos and Gurabo in the autumn of 1923 as to absolutely eliminate all the grasses in many pastures, altho most of the weeds were untouched. The larvae have been found eaten by the lizards *Anolis pulchellus* and *Anolis cristatellus*.

The rough-looking, dirty brown or reddish-brown adults have been repeatedly intercepted at light at Bayamón, and in recent years have possibly been the most common moths noted at light at Río Piedras.

Acrolophus (Anaphora) triatomellus Walsingham was identified by Prof. Forbes (1931-391) as being six adults which he collected on Vieques Island, "very close to my *triformellus*."

Acrolophus (Acrolophus) harpasen was described by Prof. Wm. T. M. Forbes (1931-391) from type specimens collected by Mr. Francisco Seín at Lares, others from Río Piedras, and one previously reported as *mimasalis* Walker ? from San Juan.

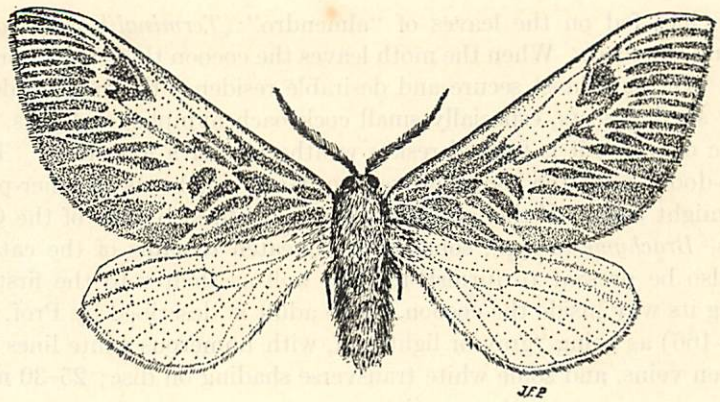
Acrolophus (Acrolophus) plumifrontellus Clemens was listed from Puerto Rico by Herr Möschler and Dr. Gundlach, but Prof. Forbes (1930-165) is of the opinion that "the Porto Rican record (of this continental species) should be verified."

Acrolophus (Acrolophus) vitellus Poey was identified from Puerto Rico by Mr. Aug. Busck, as noted in "Insectae Portoricensis" (1923-206).

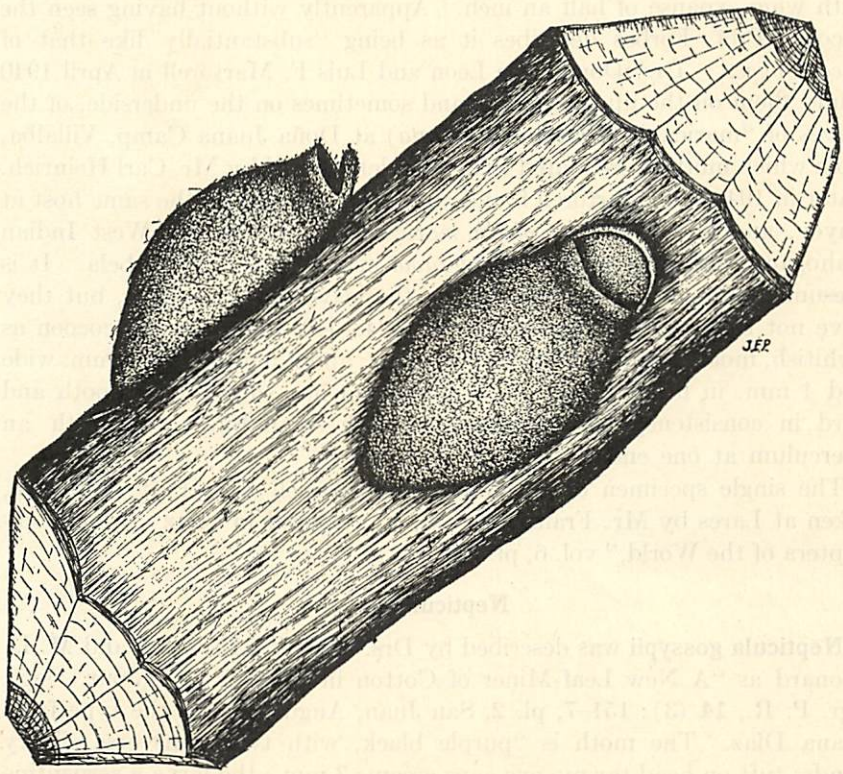
Acrolophus (Acrolophus) walsinghami was described by Herr Heinrich B. Möschler (1890-336) from a male collected in Puerto Rico by Herr Krug, and two males in the Berlin Museum, as noted by Dr. Gundlach. It is mostly "licht ziegelrot," which Prof. Forbes translates as "brick-red" when comparing with his *triformellus*, but (1930-165) describes it as "light cinnamon dusted with brown, with a dark shade through middle of fore wing from base to near outer margin, where there is a separate brown spot; 16 mm." To the non-specialist, this would seem to describe his cotypes of *triformellus* in the Río Piedras Station collection. Or possibly its interpretation depends on the color of bricks in Germany.

Megalopygidae

Megalopyge krugii was described as a *Lagoa* by Dr. Hermann Dewitz (1877-95) the type from Puerto Rico, presumably collected by Herr Krug of Mayagüez. As a *Megalopyga* it is listed by Herr Möschler, and Dr. Gundlach notes "parece ser propia solamente de Puerto Rico." The "plumilla" of Puerto Rico was possibly most intensively studied at Mayagüez by Mr. R. H. Van Zwaluwenburg, who lists it as number 1662; on *Inga vera*, *Terminalia catappa* and coffee, and (1915-31) gives *Inga laurina* as an additional host plant of the hairy white caterpillar. He continues (1915-34), "the larva is covered with long white hairs and is provided with brittle spines which cause a burning sensation if allowed to come in contact with the (human) skin. The pupa-case, with a 'trap-door' exit at one end, 16 by 10 mm., is formed of the hairs of the larva mixed with a substance secreted by the mature larva." Some persons are much more susceptible to poisoning by these innocent-looking little caterpillars, and suffer ugly lesions if they accidentally happen to come in contact with them. They occur in all parts of the Island, and tend to be omnivorous in their feeding habits, Dr. Luis F. Martorell (1948-546) listing eighteen other forest or roadside trees on the trunks of which their cocoons have been noted. The concrete posts guarding the edge of the causeway and bridge of the Arecibo River in 1938 were thickly covered with cocoons, altho the



Adult of the "Plumilla," *Megalopyge krugii* (Dewitz), two and a half times natural size. (Drawn by José F. Pietri.)



Cocoons of the "Plumilla," *Megalopyge krugii* (Dewitz), from which the adults have emerged, two and a half times natural size. (Drawn by José F. Pietri.)

larvae had fed on the leaves of "almendro" (*Terminalia catappa*) trees shading the road. When the moth leaves the cocoon the latter is promptly taken over as a most secure and desirable residence by small spiders and many small insects, especially small cockroach nymphs, and ants, for the plastic of which it is formed resists weathering for a long time. The flat "trap-door" is at the top, however, so it can not be as weather-proof as they might wish. If the larva has been parasitized by one of the Chalcid wasps, *Brachymeria* spp., some of the uneaten remains of the caterpillar will also be present to furnish food as well as shelter to the first insect finding its way inside the cocoon. The adult is described by Prof. Forbes (1930-166) as being "gray or light buff, with numerous white lines on and between veins, and some white transverse shading on disc; 25–30 mm."

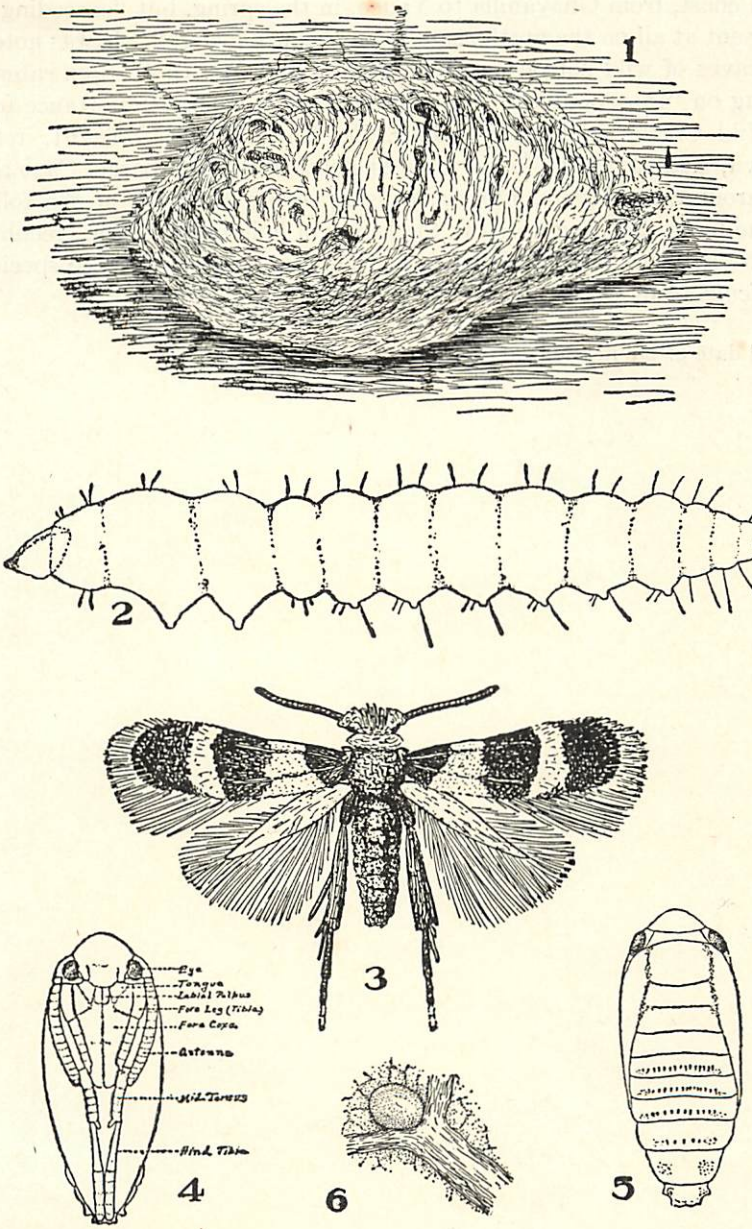
Limacodidae

Monoleuca albicollis was described by Prof. Wm. T. M. Forbes (1930-167) from a type collected at Coamo, June 5–7, 1915, mostly buff in color, with wing expanse of half an inch. Apparently without having seen the cocoon, Prof. Forbes describes it as being "substantially like that of *Megalopyge*." Drs. Donald De Leon and Luis F. Martorell in April 1940 found them on the upper surface, and sometimes on the underside, of the leaves of "maricao" (*Byrsonima spicata*) at Doña Juana Camp, Villalba, from which moths were reared that were determined by Mr. Carl Heinrich. Later in 1940, Dr. Martorell found additional cocoons on the same host at Cayey, and on "cedro" (*Cedrela mexicana*) at Cayey, on West Indian mahogany, and on "maga" (*Montezuma speciosissima*) at Isabela. It is presumed that the caterpillars fed on the leaves of these trees, but they have not been found. Dr. Martorell (1948-549) describes the cocoon as "whitish, mottled with brown, or vice versa; about 5 mm. long, 4 mm. wide and 4 mm. in height; made of a parchment-like substance, smooth and hard in consistency like a lizard's or very small bird's egg, with an operculum at one end."

The single specimen of an adult in the Cornell University collection, taken at Lares by Mr. Francisco Seín, was figured in Seitz' "Macrolepidoptera of the World," vol. 6, pl. 168, fig. g7.

Nepticulidae

Nepticula gossypii was described by Drs. Wm. T. M. Forbes and M. D. Leonard as "A New Leaf-Miner of Cotton in Porto Rico" (Jour. Dept. Agr. P. R., **14** (3): 151–7, pl. 2, San Juan, August 1930), the type from Juana Díaz. The moth is "purple black, with two transverse silvery bands; tuft on head tawny, eye-caps cream; 3 mm.; the larva a serpentine miner on the under side of cotton leaves." It is quite common on the



Nepticula gossypii Forbes & Leonard: 1, cocoon, 2, larva, 3, adult, 4 & 5, pupae, 6, egg. (After Forbes & Leonard.)

south coast, from Guayanilla to Yauco, in the spring, but "exceeding rare if present at all on the north coast or on Vieques Island." It was noted in the leaves of wild cotton on Mona Island, and Mr. C. F. Rainwater, reporting on "Insects and a Mite of Potential Economic Importance found on Wild Cotton in Florida" (Jour. Ec. Ent., **27** (4): 756–761, ref. 4. Geneva, August, 1934), found it on Anglefish Key, Key Largo, Cape Sable and around Ft. Myers, Florida, causing severe shedding of the foliage. Larvae have also been noted in the leaves of hollyhocks in the greenhouse at Río Piedras. Prof. Forbes (1931-393) reports an undescribed species of *Nepticula* from Coamo.

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[1] Date of issue 8.15.51
[2] Leave to pursue studies
[3] Military Leave
[4] Other Leaves

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THE INSECTS OF PUERTO RICO

By GEORGE N. WOLCOTT

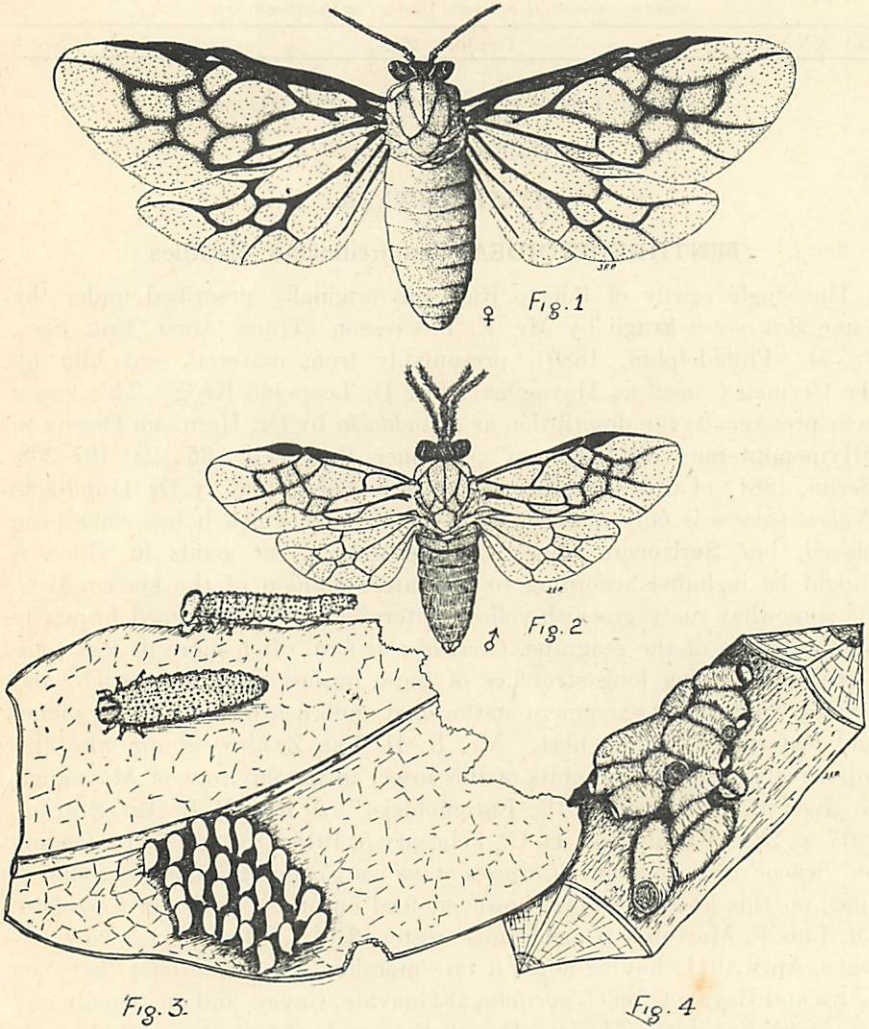
HYMENOPTERA

TENTHREDINOIDEA: Tenthredinidae: Sawflies

The single sawfly of Puerto Rico was originally described under the name *Schizocera* **krugii** by Mr. E. T. Cresson (Trans. Amer. Ent. Soc., **8**: 54. Philadelphia, 1880), presumably from material sent him by the German Consul at Mayagüez: Herr D. Leopoldo Krug. This was a year previous to the description as *S. zaddachi* by Dr. Hermann Dewitz in "Hymenopteren von Portorico" (Berliner Ent. Zeit., **25** (2): 197–208. Berlin, 1881) of this and other Hymenoptera sent him by Dr. Gundlach. *Xylosericocera* is only a MS generic name under which it has since been placed, but Sericocera appears to be the correct genus in which it should be included according to the latest opinion of the systematists. Its somewhat rusty greenish-yellow, caterpillar-like larvae feed primarily on the leaves of the seagrape, *Coccoloba uvifera*, often more or less completely defoliating long stretches of these bushes along the beach, and leaving windrows of excrement on the sand underneath the naked branches and leaf midribs of its host. Mr. R. H. Van Zwaluwenburg, who first intensively studied the habits of this insect in the environs of Mayagüez, as given in his "Report of the Entomologist" (*in* Rpt. P. R. Agr. Station, 1917, p. 28. Washington, D. C., February 5, 1918), records it also feeding on "icaco" or coco plum (*Chrysobalanus icaco*), but no one has found it since on this host. It does, however, feed on other species of *Coccoloba*, Dr. Luis F. Martorell (Caribbean Forester, **2** (3): 141–4, pl. 1. New Orleans, April 1941) having noted it on "moralón" (*C. grandifolia*) between Lares and Bayaney, on *C. pyrifolia* at Guavate, Cayey, and on "cucubano" (*C. laurifolia*) in the Maricao Forest, thousands of feet above what one is inclined to think is its normal habitat: on the beach just above sea-level.

The slender oval eggs are stuck on the leaf by one end, in a circular patch, arranged almost as equally distant from each other as the pins in a bowling alley. The thin, tough, parchment-like cocoons are attached to the trunk or branches of the seagrape, often in such numbers and so closely cemented to each other that they can be pulled off in a continuous strip.

They are not very durable, however, and rarely survive as shelter for other insects long after the emergence of the adults. The adults have shining



The Seagrape Sawfly, *Sericocera krugii* (Cresson); 1, adult female, about six times natural size, 2, adult male, 3, larvae and eggs on seagrape leaf, 4, cocoons. (Drawn by José F. Pietri.)

black head and eyes, and bright chestnut red thorax, which fades to a dull yellow-brown in museum specimens. The simple antennae of the plump females contrast with the two-branched, plumose antennae of the more ac-

tive males, which may hover in clouds in the lee of a clump of seagrape on which the females are resting.

Everywhere around the Island where seagrape grows these insects have been noted in abundance, but they are not reported from Cuba or Hispaniola, and possibly a reason why seagrape grows so luxuriantly on Mona Island is the absence of this pest. We have no records from Vieques and Culebra, but what is presumably the same species has been noted on seagrape at Paramaribo, Dutch Guiana. So far as we know, **Sericocera krugii** has no natural enemies, certainly no specific parasites, and Dr. Wetmore found it eaten by no bird. Yet after defoliating a section of the seagrapes of a beach, the insect disappears completely for months, or a year or longer, altho it may at the same time be abundant somewhere else. Most recorded outbreaks occur in the autumn or winter on seagrape, and those on other hosts in the mountains in the spring and summer, possibly indicating a mass migration depending on temperature, but one heavy infestation at Ponce was in July. Defoliation of seagrape bushes is normally so complete, and may occur so often, as to indicate this insect as unquestionably a contributing factor in preventing seagrape from often becoming a tree in Puerto Rico.

ICHNEUMONOIDEA: Braconidae

Alysia analis Cresson, as identified by Mr. A. B. Gahan, is a slender little (6.0 mm. long) black wasp, with the thorax and basal half or third of the abdomen bright chestnut, found in all parts of the Island: equally abundant in the cane fields of the coast and in the coffee groves of the mountains. Of its host relationships, nothing is known. The predaceous black and red bug *Zelus longipes* L. was observed in the mountains back of Yauco, at Indiera, feeding on one of these wasps, but we have no record of its serving as food for any bird, lizard or toad.

Alysia ridibunda Say, as identified by Mr. R. A. Cushman, is so rare in Puerto Rico that only a single specimen has been collected.

From the fruitfly traps at Mayagüez, several specimens of a new species of **Goniarcha,** as determined by Mr. C. F. W. Muesebeck, have been taken.

The fruitflies, for which these traps were set, were early found to be parasitized by what Mr. H. L. Viereck in his "Descriptions of Ten New Genera and Twenty-five New Species of Ichneumon Flies" (Proc. U. S. National Museum, **44** (1968): 555–568. Washington, D. C., April 18, 1913) named **Opius (Utetes) anastrephae,** from material reared by Dr. C. W. Hooker, of the Mayagüez Station, who gave the host as *Anastrepha fraterculus* Wiedemann (now known as *A. suspensa* Loew) maggots from the fruits of "jobo" *Spondias lutea* (now *S. mombin*). These very small yellow wasps have been repeatedly reared from this host in the western end of the Island

and in the mountains as far east as Cidra, but they are not very abundant, and presumably exert only a slight degree of control on their specific host.

Opius insularis Ashmead, as determined by Mr. A. B. Gahan, is a similar little yellow wasp which Mr. E. G. Smyth reared from Agromyzid pupae in *Hyptis pectinata*, one parasite from each pupa. Those reared by Mr. A. S. Mills from the pupae of *Agromyza jucunda* in the leaves of wild morning glory at Vega Alta were determined by Mr. C. F. W. Muesebeck as being a new species of **Opius**. From pupae of the Olethreutid moth, *Crocidosema plebeiana* Zeller, the larvae of which feed in the seed heads of "escoba" (*Sida cordifolia*) which he collected at Dorado, wasps emerged which Mr. Muesebeck identified as of this genus.

From a single pupa of the Pyralid "higüerillo" leaf-webber, *Pilocrocis inguinalis* (Guenée), collected by Dr. Luis F. Martorell at Cayey, seventeen small wasps emerged which Mr. Muesebeck identified as a new species of **Microgaster.**

Wasps of the genus *Mirax* are characterized by having 14-segmented antennae and wings of which, according to Mr. Muesebeck as stated in "A Revision of the North American Ichneumon-Flies belonging to the Subfamilies Neoneurinae and Microgasterinae" (Proc. U. S. National Museum, **61** (2436) Art. 15, 1–76, pl. 1. Washington, D. C., 1922), the "first intercubitus is long, attaining the broad triangular stigma, from the middle of which arises the radius, not angled, obsolete at extreme base." Until quite recently, no species of *Mirax* was known to occur in the West Indies, and "studies have been difficult because of the paucity of available specimens. Those species of which the habits are known are parasites of lepidopterous leaf-miners or bast-miners."

The coffee leaf-miner, *Leucoptera coffeella* (Guérin-Méneville), most exhaustively studied in Puerto Rico by Mr. Francisco Seín, was found by him to be parasitized by numerous small wasps of which none occurred in sufficient numbers to exert an appreciable effect on its abundance. In the coffee groves of the island of Guadeloupe, French West Indies, he found, however, that from 65 to 80 per cent of the leaf-miner larvae were parasitized by what Mr. C. F. W. Muesebeck named **insularis:** "A New West Indian Species of **Mirax** Haliday parasitic on the Coffee Leaf-Miner (Hymenoptera: Braconidae)" (Proc. Ent. Soc. Washington, **39** (6): 139–141, fig. 1. Washington, D. C., June 18, 1935). *Mirax insularis* is also present in St. Lucia and Dominica of the Lesser Antilles, but being most abundant in Guadeloupe, it was from that Island that shipments of the parasite were made to Puerto Rico in 1937 and 1938, for release in coffee groves at Guaynabo, Quebradillas and Lares. Recoveries of this little yellowish-brown wasp several generations later were made at Quebradillas and Lares, and

extensive collections were made for a number of years thereafter. In September 1940, a peak of parasitization of this wasp of 2.9 percent of parasitized leaf-miner larvae was noted at Lares, but for most of the time when observations were made, only a fraction of one percent of the caterpillar larvae were attacked. Following the extreme dry weather of the first half of the year 1947, however, Mr. Seín found that this imported parasite had attacked 13% of the leaf-miners at Lares in the coffee grove where it had been originally released, this being slightly more than the parasitism by all the native wasp parasites observed at this time. It had been presumed that rainfall and humidity in Guadeloupe coffee groves was approximately that of similar environments in Puerto Rico, but apparently only under extreme conditions of drought (for coffee groves) does this imported parasite become abundant. Its future course can hardly be predicted, but it would appear from all observations to date that the single effective parasite of the coffee leaf-miner in Guadeloupe, when introduced into Puerto Rico in competition with numerous others, becomes only one among many during normal weather conditions, and a quite insignificant factor in control.

In 1921, Mr. C. F. W. Muesebeck's "Revision of the North American Species of Ichneumon-Flies belonging to the Genus *Apanteles*" (Proc. U. S. National Museum, **58** (2349): 483–576, Washington, D. C.) was published, in which all the species of these slender little black wasps known from Puerto Rico up to that time were recorded and keyed, and one new species from Puerto Rico was described. The *Apanteles* wasps are exclusively parasitic on caterpillars. If the caterpillar is small, only one or a few wasps develop from it. But if the caterpillar is very large, great numbers of wasp maggots may find sufficient nourishment inside its capacious body for complete development, and, emerging from approximately evenly spaced points on its crumpling skin when fully-grown, may be so numerous that the silk of their closely-packed cocoons coalesces to form a shining white silken cylinder, out of which the shriveled skin of the parasitized caterpillar often falls before the adult wasps begin to emerge.

Apanteles dignus was described from California by Mr. C. F. W. Muesebeck (Proc. Ent. Soc. Washington, **40** (7): 203, Washington, D. C., October 27, 1938), from *Gnorimoschema lycopersicella* (Busck), the pepper flower-bud moth. In the original description, Mr. Muesebeck states: "In addition to the type series, I have before me three females and two males, unquestionably the same species, reared from *Gnorimoschema gudmannella* (Walsingham), at St. Croix, Virgin Islands, in March 1922", which considerably antedates the first record from this host for Puerto Rico.

Apanteles xanthopus, parasitic on the caterpillar of *Diatraea saccharalis* (F.) at São Paulo, was introduced into Puerto Rico in "Seven shipments of

sugarcane borer parasites received from Brasil" by Dr. K. A. Bartlett (Mayagüez Station Report for 1946, p. 31).

The clothes-moth parasite, **Apanteles carpatus** (Say), has been collected in an apartment house in San Juan, and in the cabin of a boat in the harbor, but has not been reared from the local equivalent, *Tineola walsinghami* Busck, the plaster bagworm or flattened case-bearer that infests the walls of houses, feeding on the remains of dead insects and spiders, and on woolen blankets and clothes if opportunity offers. Even when fully-grown, these caterpillars are quite small, furnishing nourishment for the development of but a single parasitic wasp.

At the other extreme are the species of *Apanteles* which parasitize large sphinx caterpillars, so numerous at times that they may form a considerable item in the food of the lizards *Anolis pulchellus*, *A. krugii* and *A. cristatellus*. In Cuba, six hyperparasites of **Apanteles americanus** (Lepeletier) are recorded. *Elasmus maculatus* Howard and an undetermined species of *Horismenus* have been reared from it in Puerto Rico when parasitizing the sphinx of yuca, and *Stiboscopus thoracicus* Ashmead as a parasite of its cocoons on the tobacco hornworm. The latter wasp is presumed to be normally an inhabitant of coffee groves and the virgin forests of the mountains, but we have no other record of its host relationships, and it may be an important factor in the control of the parasite of the tobacco hornworm, which is rarely noted attacked by *Apanteles americanus*. The sphinx caterpillars of papaya and yuca, on the contrary, are more often found attacked than free from parasitism. The first record of this wasp in Puerto Rico is of rearing by Mr. August Busck from a sphinx on "pawpaw". Presumably this was *Erinnyis alope* (Drury), which normally feeds on papaya foliage, as it has repeatedly since been found parasitized by *Apanteles americanus*, as is also the similar *Erinnyis ello* (L.), which feeds on yuca.

Dr. Gundlach, in his account of the yuca sphinx, most unfortunately was apparently recording a mis-identification of the parasite. "La oruga se cria en *Jatropha Manihot*. Muchas orugas mueren, porque un himenóptero pequeño pone centenares de huevos en una sola oruga. Las larvas de estos himenópteros, que son *Microgaster flaviventris* Cresson, salen del cuerpo, cada una forma un capullito blanco uno al lado del otro y estos todos juntos parecen una mota de algodón, pegada en el peciolo u hoja de la planta." From such an authority on Cuban fauna, this name was accepted without question by Mr. Patricio Cardín in his account of the "Insectos y Enfermedades de la Yuca en Cuba" (Bol. No. 20, pp. 28, pl. 8, Estación Experimental Agronómica, Santiago de las Vegas, July 1911), and Mr. R. H. Van Zwaluwenburg has the same specific name, *Protapanteles flaviventris* Cresson (5023), for the parasites he reared from this host in Puerto Rico. No host record is given by Cresson for the type material

from Cuba, and Mr. Muesebeck is of the opinion "that the true *flaviventris* will prove a synonym of *americanus* (Lep.)."

The sphinx caterpillar *Protambulix strigilis* (L.), feeding on "guanábana", *Annona muricata*, and the tobacco hornworm, *Phlegethontius sexta jamaicensis* Butler, are host to **Apanteles congregatus** (Say).

Mr. H. L. Viereck, receiving material which Dr. C. W. Hooker, at the Mayagüez Experiment Station, had reared from an undetermined sphinx, named the wasp after the place of its origin, **Apanteles mayaguezensis** (1913–563). Wasps identified as this species by Mr. A. B. Gahan have since been reared from a sphinx feeding on the leaves of *Cissus sicyoides*, the wild grape which is known to be the food plant for both *Pholus labruscae* (L.) and *Pholus vitis vitis* (L.).

A small cotton caterpillar, *Alabama argillacea* (Hübner), collected at Hatillo, was host for just two maggots of **Apanteles aletiae** Riley, as determined by Mr. A. B. Gahan. This is a continental species, which, as indicated by its specific name, should attack only cotton caterpillars. In Cuba, however, where cotton is not a commercial crop, it has been reared from another similar looper caterpillar, *Gonodonta mutrix* Cramer, which feeds on *Annona glabra*.

Another looper caterpillar of the genus *Phytometra* was fully-grown when numerous maggots began emerging from it, the adults of which were identified by Mr. Muesebeck as **Apanteles guayanensis** Cameron.

Apanteles militaris Walsh has been reared in Puerto Rico from a caterpillar of *Leucania latiuscula* (Herrich-Schäffer), which is a cutworm of sugar cane leaves and grasses, and not a looper.

This cutworm is also host for **Apanteles marginiventris** (Cresson), of which, according to Mr. A. B. Gahan, *Apanteles grenadensis* Ashmead is a synonym, both described from West Indian material. Its more normal host is the southern grassworm, *Laphygma frugiperda* (Abbot & Smith), of which large numbers of the small caterpillars are often attacked, so that one sometimes finds numerous individual cocoons of this wasp scattered about on cane leaves eaten by the grassworm.

Apanteles disputabilis Ashmead, as determined by Mr. Muesebeck, was noted in great abundance by Dr. Luis F. Martorell on the flowers of "malva de caballo" (*Malachra alceifolia*), beside a cane field near Central Rufina, Guayanilla. This West Indian species, found also in the southern United States, was described from St. Vincent of the Lesser Antilles. At Haina, Dominican Republic, it was reared from larva of *Panoquina nyctelia* (Latreille), a leaf-rolling skipper caterpillar which feeds on the leaves of sugar-cane.

The type of **Apanteles prenidis** Muesebeck (1920-558) was reared by Mr. Thos. H. Jones from the same species of skipper caterpillar, which

at that time was called *Prenes ares* Felder, in a cane field of Hda. Monserrate, Luquillo. As few as five parasites may develop in a single small larva, but in a more fully-grown caterpillar the mass of white cocoons may almost fill the silken shelter in the rolled-over cane leaf which this skipper heavily reinforces when about to pupate. The other common skipper caterpillar of sugar-cane, *Panoquina nero belli* Watson, is also host for *Apanteles prenidis*.

The common skipper caterpillar on beans, *Urbanus proteus* (L.), is host for **Apanteles leucostigma** (Ashmead), described from St. Vincent and Grenada of the Lesser Antilles, but since reared from this host in all the Greater Antilles. In Cuba, this wasp has as hyperparasites *Horismenus eudami* Girault and *Elasmus maculatus* Howard.

Mr. C. F. W. Muesebeck has identified as "near *nigriceps* Ashmead" an *Apanteles* collected in a citrus grove at Pueblo Viejo. Undetermined species of *Apanteles* have been reared from *Lamprosema indicata* (F.) at Isabela, from *Pseudohemiceras krugii* Möschler at Salinas, from *Phostria martyralis* (Lederer) at Guayama, and from *Crocidosema plebeiana* Zeller at Dorado, but as all but the last of these are Pyralid hosts, the numerous records may indicate but a single species of *Apanteles*. From the Pyralid *Desmia ufeus* (Cramer) has been reared **Apanteles ruficollis** (Cameron) as determined by Mr. Muesebeck, and from the Bougainvillea leaf-tyer, *Sylepta gordialis* (Guenée), a new species very similar to *ruficollis*.

Iphiaulax voraginis (Cresson), which Dr. Gundlach reports collecting at Quebradillas, and Dewitz lists as a *Bracon*, was originally described from Cuban material as being "rufous; head, antennae and legs, black; wings fuscuous, abdomen broad, with deep excavation on each side of the second segment and a smaller one on each side of the third segment; ovipositor longer than the abdomen", and Mr. Cresson also mentions a large hyaline spot on the fuscous wings, and gives the length of the female as two and one-half lines. This agrees fairly well with specimens collected by Dr. Luis F. Martorell in considerable abundance on the tops of bushes on the plateau of Mona Island, identified by Miss G. A. Sandhouse as a species of *Iphiaulax*, and may represent what Dr. Gundlach found in Puerto Rico. The males are much smaller, and Martorell found them much more numerous than the very conspicuous females, with their broad, shining, bright chestnut abdomens.

Dr. Gundlach collected at Mayagüez and Dewitz lists another of Cresson's Cuban species of *Bracon*, subsequently found at the same locality by Mr. R. H. Van Zwaluwenburg (50) and identified for him as **Monogonogaster ventralis** (Cresson). This is larger, four and three-quarters lines long, "readily distinguished from the other species by the abdomen only

being rufous", and has most recently been collected in a citrus grove at Trujillo Alto.

Bracon guanicana Wolcott ("IP" 1923-67), is mostly shining yellowish brown, 6.0 mm. long, described from specimens collected in a screen trap in the garden at Hda. Santa Rita, Guánica, by Mr. E. G. Smyth, and since found on swamp vegetation at Boquerón.

Among the "Imported Parasites of Pink Bollworm at Presidio, Tex. 1932–36" handled by Messrs. L. W. Noble and W. T. Hunt (Jour. Ec. Ent., **30** (6): 242–44. Menasha, December 1937) were over three thousand *Exeristes roborator* F. from southern Europe and Egypt, fourteen thousand *Chelonus blackburni* Cameron from Hawaii, and forty thousand *Microbracon kirkpatricki* Wilk. from east central Africa, which were sent to Puerto Rico for release in areas infested by the pink bollworm. None of these has since been recovered, but so many little wasps were subsequently noted on the window-sills of the cotton ginnery and warehouse at Isabela that several people who had watched with interest the release of the parasites were sure that millions of them were being destroyed by being trapped in the ginnery. Specimens collected in January 1940, submitted to Mr. C. F. W. Muesebeck, were identified as **Microbracon hebetor** Say. This is a wasp previously reported once from Puerto Rico: resting on pigeon peas at Ponce. It is a common continental species, "length 2–3 mm., black with yellowish markings, variable in color and size, (which) apparently exclusively attacks the Lepidoptera in stored grain, dried fruits, etc.", according to Prof. E. O. Essig (1926–783). No pink bollworm moths were noted dead or alive on the windows of the Isabela ginnery at the time when these wasps were so abundant, but numerous stored grain moths were present. Mr. L. Courtney Fife, in his study of the cotton insects of Puerto Rico (Bulletin No. 39, Mayagüez Experiment Station, pp. 14, ref. 45. Washington, D. C., March 1939) noted that "two species of pyralids were found attacking stored cottonseed, namely *Ephestia cautella* and *Corcyra cephalonica*. The larvae of this species (the former) were rather heavily parasitized by *Microbracon hebetor*." Two other less abundant species of *Microbracon* have been definitely identified from Puerto Rico, besides several others not placed as to species.

Microbracon cushmani Muesebeck, as identified by Mr. Muesebeck, was reared by Dr. Luis F. Martorell from caterpillars of the roble leaf-roller, *Eulepte concordalis* Hübner, at Naguabo, Maunabo and Mona Island. From the shrunken skins of dead caterpillars numerous creamy maggots emerged, resting on the leaf before beginning to spin their fine silken cocoons and darkening for pupation, as noted by Dr. Martorell (Caribbean Forester, **2** (1): 19. New Orleans, October 1940).

Microbracon thurberiphagae Muesebeck has been reared from the caterpillars of the lima bean pod-borer, *Maruca testulalis* (Geyer), at Cidra and at Vega Baja, but obviously is too rare to be a serious factor in the economic control of this pest.

No specific name was assigned to those *Microbracon* wasps reared by Mr. Thos. H. Jones from the sugar-cane skipper caterpillar, *Panoquina nyctelia* (Latreille), at Luquillo and at Río Piedras. Numerous fine yellowish silken cocoons of the parasite were crowded into the shelter which this caterpillar makes by folding over a leaf, and from them emerged light yellow adult wasps. No subsequent rearing in Puerto Rico has been made from this host, but from a similar leaf-roller on rice at Haina, Dominican Republic, similar adults were considered by Mr. Muesebeck to be "possibly *femoratus*." From the leaf-miner, *Acrocercops dives* (Walsingham), in the leaves of *Inga vera*, collected by Mr. Francisco Seín at Lares, he reared a wasp of this genus, and Mr. A. S. Mills reared from the escoba seed-head borer, *Crocidosema plebeiana* Zeller, another undetermined species of *Microbracon*. The one reared from fruitfly maggots, *Anastrepha mombinpraeoptans* Seín, as reported by Dr. K. A. Bartlett, is most certainly a new species.

In addition to the *Chelonus blackburni* Cameron introduced into Puerto Rico to combat the pink bollworm, a comparable introduction against the sugar-cane moth borer, *Diatraea saccharalis* (F.), was made (Rpt. P. R. Agr. Expt. Station at Mayagüez, 1938, p. 97. Washington, D. C., November 1938) of the wasp parasite *Chelonus annulipes* Wesm. "This braconid is a small wasp which was imported into the United States from Italy (and reared at the Toledo, Ohio laboratory) as a parasite of the European corn borer, *Pyrausta nubilalis* (Hübner). Under laboratory conditions (at Mayagüez), it was possible to obtain oviposition by *Chelonus* in *Diatraea* eggs and to rear the parasites successfully through to the adult stage. Of the total of 65,800 *Chelonus* adults shipped from Toledo, 43,459 arrived alive. Liberations were made throughout the cane-growing areas under various environmental conditions, a total of 43,249 adults being liberated in colonies of approximately 1,000 each". And, as in the case of *Chelonus blackburni*, no subsequent field recovery of *Chelonus annulipes* has been reported.

Endemic species of *Chelonus* do occur in Puerto Rico, however, **Chelonus meridonalis** Ashmead having been identified by Mr. Muesebeck from material intercepted on *Pluchea purpurascens* at Pt. Cangrejos by Mr. A. S. Mills, and also by him, **Chelonus texanus** Cresson on weeds at Loíza. Mr. Francisco Seín has reared an unidentified species of **Chelonus** from the pepper flower-bud moth, *Gnorimoschema gudmannella* (Walsingham).

Chelonus insularis Cresson, originally described from Cuba, but early found in Puerto Rico by Dr. Gundlach, and listed by him and Dewitz, and

subsequently by Van Zwaluwenburg, is considerably more abundant, and potentially of much greater economic importance. In the first year that Mr. D. L. Van Dine spent in Puerto Rico he reared it from a partly grown corn earworm, *Heliothis armigera* (Hübner) collected at Caguas, September 3, 1911 and accompanied by the young British Entomologist, Mr. G. E. Bodkin, en route to Demerara after having taken graduate work in the United States as a Carnegie scholar, on January 5, 1913, oviposition was observed at Guánica in the hairy egg-clusters of *Laphygma frugiperda* (Abbot & Smith). In the humid, swampy cane fields of British Guiana, Mr. Bodkin was promptly to repeat this observation, and rear adults. Because Mr. Thos. H. Jones at that time had in preparation a paper on the southern grassworm in Puerto Rico, the unique method of oviposition and development of the parasite was not reported by Mr. Van Dine.

"The female of *Chelonus insularis* Cresson, after removing a portion of the hairs from the egg-cluster, lays her eggs in the eggs of the moth. Caterpillars from these eggs issue normally, but they contain the maggots of the wasp which kill them before they are more than half grown. The small caterpillars enter the soil as if about to pupate, but soon die, and cocoons of the parasite will be found within the shriveled remains of the host caterpillar". Thus wrote Mr. Thos. H. Jones in describing its parasitism of one of "The Caterpillars which eat the leaves of Sugar-Cane in Porto Rico" (Jour. Agr. Dept. P. R., **6** (1): 38–50, fig. 9. San Juan, October 1922). Surprisingly enough, the parasite appears to be not particularly specialized as to host, for recently Dr. Luis F. Martorell reared adults, definitely identified as being this species by Mr. C. F. W. Muesebeck, from the caterpillars of the guano leaf-roller, *Pantographa limata* Grote & Robinson. The adult wasp, to paraphrase Mr. Cresson's original description, is two and one-half lines long, opaque black, finely and densely rugose or shagreened, except for obscurely testaceous legs and "a more or less distinct pale spot on each side of the abdomen near its base". The abdomen appears unsegmented, showing no ovipositor at apex, which is broadly rounded. The wings are hyaline, the apical half faintly dusky. Adults are often noted in fields of young corn or cane, and are indeed of sufficient abundance at times as to form an item of food for the lizard *Anolis cristatellus*.

Rogas nigristemmaticum Enderlein, doubtfully identified as to species by Mr. C. F. W. Muesebeck, was reared by Mr. Thos. H. Jones from larvae of the cane looper, *Mocis repanda* (F.), at Guánica in 1913, and was reported (Jones & Wolcott 1922–49) as a new species of *Rogas*, according to the original determination of the material by Mr. A. B. Gahan. This yellow wasp has since been collected in flight at Bayamón, but obviously is not common, and can hardly be an important factor in the control of its host.

Crassimicrodus fenestratus Viereck (1913-559), described from Puerto Rican material presumably collected at Mayagüez, is an entirely black wasp except for the scapula and tegula of the thorax, the abdomen and the distal half of the anterior femora. Its wings are dusky, except for two irregular cleared fenestrated areas in the forewings. It was most recently found in the screen trap in the garden at Hda. Santa Rita, Guánica, by Mr. E. G. Smyth. Nothing is known as to its host relationships.

Yelicones species, as identified by Mr. S. A. Rohwer, is a yellowish-brown wasp reared from the pupa of *Tetralopha scabridella* Ragonot. The caterpillars of this moth make so-called "butterfly nests" with the leaves of the coffee shade tree, *Inga vera*.

Macrocentrus ancylivorus Rohwer is an introduced Braconid released at Isabela in an attempt to control the lima bean pod-borers by natural means. It has not been recovered in the field. An endemic *Macrocentrus*, unidentified as to species, was reared by Mr. A. S. Mills from larvae of *Crocidosema plebeiana* Zeller in the seed heads of "escoba" (*Sida cordifolia*), and from the caterpillars of a Gelechid moth of the genus *Aristotelia* feeding on hibiscus at Vega Alta.

Phanerotoma planifrons Nees is another introduced parasite of lima bean pod-borers which has not been recovered in the field since the release of hundreds of adults at Barceloneta, Aguada and Guánica in June 1936. "The material originated in France and was shipped to the United States in the cocoon stage, where it was reared and shipped to Puerto Rico in the adult stage." Five thousand of these wasps were sent from Moorestown, New Jersey, over 96 percent of which reached Puerto Rico alive, but many of them died in large laboratory cages before release. An endemic *Phanerotoma*, unidentified as to species, has been intercepted on the leaves of *Adenanthera* at Bayamón.

Heterospilus etiellae Rohwer, an endemic parasite of one of the lima bean pod-borers, *Etiella zinckenella* (Treitschke), was first reported from Puerto Rico by Dr. M. D. Leonard and Mr. A. S. Mills (Jour. Ec. Ent., **24** (2): 466–473. Geneva, April 1931, see p. 470): a single specimen identified by Mr. A. B. Gahan. Several of these caterpillars taken from lima bean pods at Isabela in the summer of 1932 were noted with eight to ten dull pinkish maggots externally feeding on each until the caterpillar skin was sucked dry. Deserting the shrunken mummy the maggots spun whitish or brownish cocoons nearby, from which small yellow wasps emerged ten days later. These adults were identified by Mr. C. F. W. Muesebeck, as were others later reared from the same kind of caterpillars infesting the pods of *Crotalaria incana*. Actually, this wasp is of negligible importance in the control of its host, less than one percent of the caterpillars being attacked. Another endemic *Heterospilus*, unidentified as to species, has

been repeatedly intercepted: on guava at Bayamón and Arecibo, on grapefruit at Naguabo, Trujillo Alto and Arecibo.

Numerous other Braconids, identified only as to the genus, have been intercepted in Puerto Rico by various members of the personnél of the San Juan office of the Bureau of Entomology & Plant Quarantine. Mr. C. F. W. Muesebeck determined **Ascogaster,** from Caguas; **Hormius,** on leaves of lignum-vitae at Salinas; **Hoploteleia,** on leaves of almendro at Bayamón, and **Meteorus** and **Neoclinocentrus,** on leaves of *Adenanthera* at Bayamón.

A species of **Trigonophasmus,** as identified by Mr. Muesebeck, was collected by Dr. Luis F. Martorell in flight near the edge of the cliff on the Carmelita trail on Mona Island, April 1, 1940.

Ipobracon rimac Wolcott, a parasite of the caterpillars of the sugar-cane moth-borer, *Diatraea saccharalis* (F.), in Peru, was found in all the cane and corn fields in the region around Trujillo "in extraordinary abundance" by Mr. S. M. Dohanian (Jour. Agr. Univ. P. R., **21** (2): 237–241. Río Piedras, July 1927) during April and May 1936. To Puerto Rico he sent over ten thousand adults of this striking red and black wasp, but over two-thirds of them died en route, and no recovery has since been made in the field. The wasps are large and clumsy, and one might anticipate them as falling an easy prey to the active lizards of Puerto Rican cane fields. *Ipobracon amabilis,* in "seven shipments of sugar-cane borer parasites received from (São Paulo) Brazil" by Dr. K. A. Bartlett (Mayagüez Station Report for 1946, p. 31) was released at Hormigueros.

Bassus stigmaterus Cresson is another, but considerably smaller and less conspicuous, parasite of caterpillars of the sugar-cane moth-borer, *Diatraea saccharalis* (F.), which, under the name *Microdus diatraeae* Turner was first brought to Puerto Rico as pupae in cold storage by Mr. Harold E. Box from British Guiana in 1924 and 1925. The complicated story of "The Introduction of Braconid Parasites of *Diatraea saccharalis* Fabr., into Certain of the West Indian Islands" (Bull. Ent. Research, **18** (4): 365–370, pl. 1, fig. 2. London, May 1928) is not simplified by confusion in the identifications of the wasps concerned, but of this species, Mr. Box claims that "field recoveries were made of three cocoons and two parasitized borers during February and March 1925, and four more cocoons during December 1926, on one of the properties of Central Aguirre Sugar Company not far from where the original releases had been made". Additional introductions were made by Mr. S. M. Dohanian (1937-239) from British Guiana, 4.8% of subsequent parasitism being reported (Anon. 1938-97) by Dr. Kenneth A. Barlett at Hormigueros in January 1936. Subsequently, Dr. Bartlett introduced a new xerophytic race from São Paulo, Brasil, of which three adults were released at Santa Isabel (Anon. 1940-105), for, despite the record of recovery by Mr. Box at Aguirre, Dr. Bartlett wrote that

"*Bassus stigmaterus*, already occurring in Puerto Rico, is found in areas of high rainfall, but never on the south coast". The original identification of reared material from Hormigueros, made by Mr. C. F. W. Muesebeck, was *Bassus* (*Microdus*) *sacchari* Myers, but all of these names refer to a single, not very common wasp, of negligible economic importance in Puerto Rico as a parasite of the moth-borer, of which the most recent record is of finding a single adult in a cane field at Isabela. The persistent scarcity of *Bassus stigmaterus* in Puerto Rico is all the more surprising, not only because of its abundance in Cuba and South America, but when introduced into the cane-growing areas of southern Florida, it promptly became established, and, despite freezing winters, may parasitize 5% of moth-borer larvae in early spring, and after mild winters is often more than twice as numerous.

Ipobracon grenadensis Ashmead was first brought to Puerto Rico as reared pupal material from British Guiana in 1924 and 1925 by Mr. Harold E. Box. In 1926, while employed by Central Aguirre, he sent large numbers of these wasps from Venezuela, the work of rearing and shipping being continued by Mr. Luis A. Catoni. Despite the large numbers sent to Puerto Rico, this larger parasite of the caterpillars of the sugar-cane moth-borer, *Diatraea saccharalis* (F.), did not become established. Sixteen hundred adult females and many more males were sent from La Guayra to San Juan, over eighty percent of which survived the steamship trip for release at Aguirre, but not one wasp has since been seen in the field. The elapsed time en route varied from four to eight days, and involved hardships for the wasps that the present daily direct airplane flights would entirely avoid.

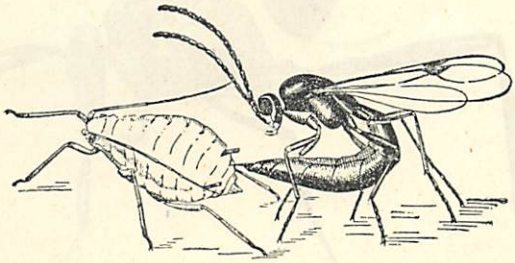
Mr. H. K. Plank, who for many years has been working on the powder post beetles of bamboo, reared from *Dinoderus minutus* F. a small brown wasp which was described by Mr. C. F. W. Muesebeck as one of "Two New Reared Species of *Doryctes* (Hymenoptera: Braconidae)" (Proc. Ent. Soc. Washington, **43** (7): 149–152. Washington, D. C., October 31, 1941) under the name **Doryctes parvus**. Mr. Plank noted (Anon. 1941-78) that "in Puerto Rico it appears to be relatively scarce and of little importance in the control of this beetle."

From a dead ucar (*Bucida buceras*) at Guánica infested with Anobiid beetles and their immature stages, *Petalium portoricensis* Fisher, in April 1940 Dr. Donald De Leon reared ten males and ten females of a wasp identified by Mr. C. F. W. Muesebeck as a new species of **Callihorminus**.

Rhyssalus brunneiventris Ashmead, as identified by Mr. C. F. W. Muesebeck, was first reared from the wedding cake scale, *Icerya montserratensis* Riley & Howard, at Pueblo Viejo by Mr. Francisco Seín, and has since been recovered from scale insect material from Isabela and Barceloneta. It occurs in considerable abundance, and may be the explanation

of the normal scarcity of this scale most of the time, interrupted by short-lived mass infestations on "laurel de la India" (*Ficus nitida*), as in the plazas of Caguas and Manatí. It is a small, bright yellow wasp, with lighter yellow legs, but with the eyes, antennae and wing veins black.

Aphidius testaceipes Cresson is a small, inconspicuous black wasp, rarely noted as an adult, but actually so common as often to parasitize practically all aphids on one host in a limited area. The often copied illustration, first published by Dr. F. M. Webster, shows the female in characteristic position facing the aphid, with her abdomen extended forward under her legs, the sharply pointed ovipositor piercing the rear of the aphid being parasitized. But a single egg is laid in the aphid by the wasp, and as the individual aphid is rather small for furnishing sufficient nourishment for the maggot of the wasp, the aphid is stimulated to grow much larger than it normally would. Such bloated aphids are most noticeable after the adult wasp has emerged, their dead, dry, papery bodies being pierced with



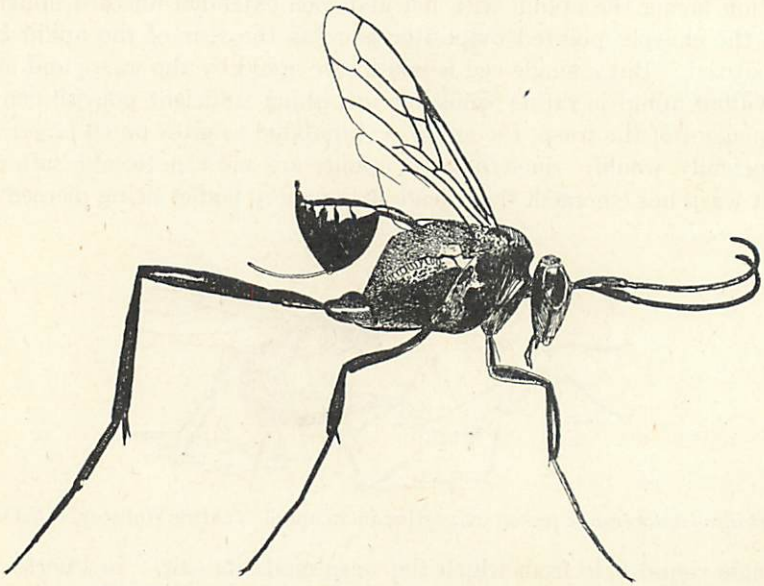
Aphidius testaceipes Cresson ovipositing in an aphid. (After Webster, U.S.D.A.)

a single round hole from which the wasp made its exit. In Puerto Rico, the presence of this parasite was first reported by Mr. Thos. H. Jones, attacking *Hysteroneura setariae* Thomas on sugar-cane, but it is not restricted to any particular species of aphid on any particular host plant. It has been noted here attacking *Aphis gossypii* Glover on "roble" (*Tabebuia pallida*) at Humacao, and on cucumber at Río Piedras and at Caguas; *Toxoptera aurantii* Fonscolombe on grapefruit leaves and on the leaves of "mamey" (*Mammea americana*) at Pt. Salinas; *Myzus persicae* Sulzer on egg-plant at Loíza, and undetermined aphids on orange, okra, sorghum and corn. Dr. F. M. Wadley (1937-106) noted its attack on the vector of mosaic disease of sugar-cane, *Aphis maidis*, and on *Hysteroneura setariae*. Under the generic name of *Lysiphlebus*, Mr. L. Courtney Fife (1939-9) reports parasitism on *Aphis gossypii* Glover on cotton.

Evaniidae

In addition to cockroaches scurrying for cover when a light is suddenly turned on in kitchen or garage, one may sometimes see a large shining

black wasp nervously running about, its long hind legs quite out of proportion to its stalked, short, laterally flattened, triangular abdomen. This is **Evania appendigaster** L., a specific parasite on the egg-clusters of the larger domestic cockroaches. Under the name of *Evania laevigata* Olivier, it is mentioned by Dr. Dewitz, and of it Dr. Gundlach states: "Se encuentra muchas veces en las casas, donde la larva se cría en las oötecas de las cucarachas". Only one wasp develops in all the eggs present in a single oötheca, and as the wasps, relative to the number of cockroaches, are quite abundant,



Evania appendigaster Linnaeus, five times natural size.
(Drawn by G. N. Wolcott.)

they are a factor of considerable importance in cockroach control, active in all parts of the Island.

Evania ruficaput, described by Dr. Hermann Dewitz (1881-205) from material collected by Dr. Gundlach at Mayagüez, has not since been noted.

Hyptia rufipectus, also described by him (1881-205) from specimens collected at Mayagüez by Dr. Gundlach, and **Hyptia petiolata** F., listed by him, Dr. Gundlach and Mr. W. M. Ashmead, have also eluded collection in recent years.

Brachygaster pygmaeus (F.), as determined by Mr. R. A. Cushman, is a small Evaniid wasp, with dark red head and prothorax, not a domestic insect and not found in houses, but sometimes noted in considerable abundance in the field, resting on leaves of sugar-cane, or of papayas, and most

recently on "palo de muñeca" (*Rauwolfia tetraphylla*) at Guayama. Nothing is definitely known as to its host relationships, but presumably it parasitizes the oötheca of small, wild, outdoor cockroaches.

Ichneumonidae*

Calliephialtes ferrugineus, described by Mr. R. A. Cushman as one of his "New Genera and Species of Ichneumon Flies, with Taxonomic Notes" (Proc. U. S. National Museum, **88** (3083): 355–372. Washington, D. C., 1940), on page 362, the type from Boquerón, was reared from larvae of the pink bollworm, *Pectinophora gossypiella* (Saunders), by Dr. K. A. Bartlett. In May 1940, Dr. Luis F. Martorell reared these wasps, one from each of two larvae of the mahogany shoot borer, *Hypsipyla grandella* (Zeller), in "cedro" (*Cedrela mexicana*) at Cayey, and others had previously been found in a grapefruit grove at Añasco, indicating an extensive distribution in Puerto Rico. As might be inferred from the specific name, the wasps are mostly ferrugineous in color, the head, scutellum and abdomen being definitely red, but with the white legs marked with black, the antennae and ovipositor-sheath black, the wings hyaline, "venetian black."

We are so accustomed to think of spiders as spinning webs in which to catch flying insects, or as jumping on unsuspecting terrestrial insects, that it at first seems a complete reversal of the natural order that some insects should attack spiders, or parasitize their eggs. Large slender wasps, with long brownish antennae, have been noted in the act of ovipositing in spider egg-masses, and if many of the egg-masses of some of the larger web-spinning spiders are collected, some of them may be found to be parasitized, as many as fourteen males and two females having been reared from one collected at Lares. This material was cited by Mr. Cushman (1940-363), who identified the wasps as the Cuban **Tromatobia lateralis,** described by Mr. E. T. Cresson "On the Hymenoptera of Cuba" (Proc. Ent. Soc., **4** (1): 1–200. Philadelphia, January 1865) on page 34 as a *Clistopyga*: "Honey

O Townes

* To modernize the nomenclature of the Puerto Rican Ichneumonids, the following new synonymies and new combinations are proposed:

Pimpla rufoniger Cresson, 1865 = *Coccygomimus rufoniger* (Cresson), new combination.

Pimpla marginella Brullé, 1846 = *Coccygomimus marginellus* (Brullé), new combination.

Christolimorpha plesius Viereck, 1913 = (*Hemiteles*) *Christolimorpha fuscipennis* (Brullé, 1846), new synonymy and new combination.

Charops unicincta Ashmead, 1900 = *Charopsimorpha unicincta* (Ashmead); new combination.

Ophion concolor Cresson, 1865 = *Enicospilus flavus* (Fabricius), new synonymy.

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yellow, face and orbits white, antennae brown, abdomen ferrugineous, with five black spots on each side; wings hyaline, areolet triangular, slightly oblique; female length 4½ lines, ovipositor blackish, male length 3½ lines". They are identical with what Dr. Dewitz described (1881-205) from material collected at Mayagüez by Dr. Gundlach as *Ephialtes cressoni*, the name listed by Dr. Gundlach. They also occur on Mona Island, four large females and eight of the smaller and more slender males having been reared from several egg-masses covered with green silk of *Argiope argentata*, the large, silver-striped spider whose tough webs obstruct little-traveled paths between bushes and in the artificial forest back from the beach.

Coccygomimus marginellus (Brullé), listed as a *Pimpla* by Drs. Stahl and Gundlach, and by Ashmead, has not since been collected in Puerto Rico.

Coccygomimus rufoniger (Cresson), listed as a *Pimpla* ("IP Sup" 1924–36), collected by Mr. S. S. Crossman at Aibonito, has since been intercepted at Arecibo by Mr. A. S. Mills, and found on leaves of "maga" (*Montezuma speciosissima*) at Camp Doña Juana, Villalba by Dr. Donald De Leon.

Theronia nubecularia (Dewitz), described as a *Pimpla* (1881-206) from material collected at Mayagüez by Dr. Gundlach, and thus listed by him, is possibly what Dr. Stahl lists as *Pimpla bicinta* Cresson. No wasp answering to either description has since been found in Puerto Rico.

Labena sp. nov. was the identification given by Mr. R. A. Cushman to a wasp intercepted at light at Mayagüez.

Tryphon cerebrus Dewitz (1881-206), described from specimens collected by Dr. Gundlach, and listed by him, has not since been found.

Stiboscopus thoracicus Ashmead, incorrectly reported (Wolcott 1937–144) as a not very common parasite of the coffee leaf-miner, *Leucoptera coffeella* (Guérin-Méneville), from Lares, has been repeatedly intercepted in the high mountainous forests and in coffee groves, on El Yunque, at Adjuntas and Villalba, and even at light at Bayamón. Its true host relationship was shown when Dr. Luis F. Martorell reared it from *Apanteles* cocoons developing on the outside of the tobacco hornworm, *Phlegethontius sexta jamaicensis* Butler, but as all cocoons were parasitized, the species of *Apanteles* attacked is uncertain.

A wasp intercepted on almendro at Bayamón, originally determined as a species of *Allocota*, Dr. H. K. Townes now calls a species of **Phobetes.**

Christolimorpha subflavescens (Cresson), listed by Dr. Stahl as a *Hemiteles*, is considered by Dr. H. K. Townes to be what Drs. Dewitz and Gundlach list as *Hemiteles incertus* Cresson. A single male has since been collected at Ciales, in a coffee grove. In general color it is "rufous; antennae and abdomen black, the latter banded with white, metathorax with two long acute white spines, wings clouded, iridescent" to quote Mr. Cresson, who continues that "this species answers in some respects to the descrip-

tion given of *H. fuscipennis* Brullé, from Hayti, but I am uncertain of their identity. It may be only a variety of that species. Prof. Poey informs me that this species devours the chrysalis of his *Pyralis flegialis*." Haitian females lack the "two long acute white spines," but possess a long black ovipositor-sheath and rufous ovipositor.

Christolimorpha fuscipennis (Brullé) is considered by Dr. H. K. Townes to be what Mr. H. L. Viereck (1913-564) described as *C. plesius*, the type from Mayagüez, where it has since been intercepted by Mr. A. G. Harley. It has also been intercepted at San Juan, and on mango flowers at Bayamón, according to re-determination of the material by Dr. Townes, as well as at Ciales, Morovis, Villalba and Maricao.

Acroricnus cubensis (Cresson), as determined by Mr. R. A. Cushman, was reared by Mr. Francisco Seín as a parasite of the mud-dauber wasp, *Eumenes ornatus* Saussure, one of the parasitic wasps emerging from each cell of the nest. In general color, this large wasp is more black or dark than as described by Mr. Cresson (as a *Cryptus*): "yellowish, shaded with dusky; sides of mesothorax, base of metathorax, hind legs in part and three basal segments of abdomen, black; wings yellowish hyaline." In Cuba "this species is parasitic on the larva of *Pelopoeus lunatus* Fab.," another mud-dauber wasp. Wasps twice intercepted on mango trees at Trujillo Alto have been identified as being a species of **Messatoporus,** and others on weeds at Bayamón as a species of **Amblyteles.**

Carinodes havanensis (Cameron), a large wasp with black head and thorax spotted with yellow, shining chestnut abdomen and legs, was first collected in Puerto Rico by Dr. C. W. Hooker at Mayagüez, and one specimen has since been found at Río Piedras. Nothing is known of its host relationships.

Limonethe meridionalis (Cresson), a continental species described originally as an *Ichneumon*, and thus listed from Puerto Rico by Dr. Stahl, is "black; antennae with a white annulus, wings fuscous; abdomen, except first segment, rufous; central area of metathorax large, subquadrate, indistinct, length 5½ lines." As a *Tetragonchlora* it was identified by Mr. R. A. Cushman for Dr. Richard T. Cotton, who swept it from weeds at Río Piedras. More recently, specimens found on weeds at Río Piedras, and intercepted at Santurce and Aibonito, have been re-studied by Dr. H. K. Townes who thinks they represent "a distinct endemic species."

Lissonota sp. was the determination by Mr. R. A. Cushman of a wasp reared from a pupa of the bucare stem-borer, *Agathodes designalis* Guenée, at Cayey.

Stenomacrus sp. was the identification by Mr. R. A. Cushman of wasps intercepted on grapefruit at Naguabo and resting on *Adenanthera pavonina* at Bayamón.

Eiphosoma annulatum Cresson, a very slender yellow wasp, narrowly striped or banded with black, and with a very long and slender, deeply arched abdomen, "shaped somewhat like an inverted cimeter," was listed from Puerto Rico by Drs. Dewitz, Stahl and Aldrich, and Dr. Gundlach reports it "en Utuado". It is not noticeably a mountainous species, as this might indicate, for later collections have been made at Río Piedras, Aguadilla, Salinas, Guayanilla and Guánica. Mr. Cresson states that "Prof. Poey informs me that this species is 'parasitic upon a larva of *Pyralis*,'" and Mr. E. G. Smyth at Guánica "reared it from a leaf-roller larva."

Eiphosoma insularis Viereck (1913-564), an endemic species, was reared by Mr. Thos. H. Jones at Río Piedras from the tobacco "pega-pega," *Psara periusalis* (Walker), and by Dr. Donald De Leon at Patillas from the péndula leaf-roller, *Pyrausta cerata* (Fabricius).

Eiphosoma nigrovittatum Cresson, listed from Puerto Rico by Drs. Gundlach, Dewitz and Ashmead, has since been swept from carrots at Río Piedras by Dr. Richard T. Cotton.

Eiphosoma vitticollis Cresson, found at Guánica, is somewhat larger than the others, and less black, "the metathorax having only a central black line," and "the narrow dorsal surface (of the abdomen is) blackish."

Cremastus sp., spp. or sp. nov., as determined by Mr. R. A. Cushman, has been repeatedly intercepted: on weeds at Pueblo Viejo and Dorado, on milkweed flowers and crotalaria flowers at Bayamón, and on kunquat at Arecibo.

Idechthis canescens (Gravenhorst) was intercepted resting on bananas in a boat in San Juan harbor.

Charopsimorpha unicincta (Ashmead) has been intercepted at San Juan.

Ophiopterus cincticornis (Cresson), listed from Puerto Rico by Dr. C. W. Hooker as *Ophiopterus ferrugineus* (Cresson) on p. 94 of "The Ichneumon Flies of America belonging to the Tribe Ophionini" (Trans. Amer. Ent. Soc., **38** (1 & 2): 1–176, pl. 3, fig. 18. Philadelphia, June 12, 1912), has not since been found here.

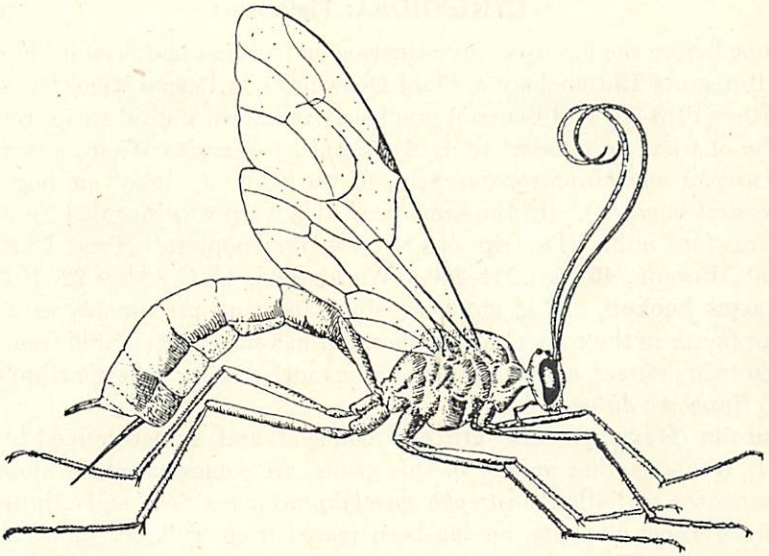
Ophion ancyloneura Cameron has been repeatedly intercepted at light, at San Juan and at Bayamón.

Ophion bilineatus Say, a very large yellow wasp with flattened, cimeter-shaped abdomen, was listed from Puerto Rico by Dr. C. W. Hooker (1912-45), and a specimen subsequently collected at Guánica by Mr. G. B. Merrill was identified as this species by Mr. R. A. Cushman. Others in the Río Piedras collection which appear to be the same were found at light at Río Piedras and at Arecibo. This is a continental species, "length 10–20 mm., varying in color from pale yellowish to reddish brown; one of the commonest species, occurring throughout boreal North America, parasitic on the larvae and pupae of a large number of Lepidoptera, including *Telea polyphemus*

(Cramer), *Samia cecropia* (Linn.), and other arctiid and noctuid moths", according to Dr. E. O. Essig (1926-792).

Ophion biangularis Taschenberg is the identification of a wasp for Mr. R. H. Van Zwaluwenburg, collected at Mayagüez and listed by him (P. R. 1026).

Ophion bicarinatus Cresson and *Ophion obsoletus* Cresson are MS names of Ichneumonid wasps collected at Mayagüez by Dr. Gundlach and listed by him as such.



The Ichneumonid wasp *Ophion* sp., about four times natural size. (Drawn by Fritz Maximilien.)

Pristomerus sp. is the identification by Mr. R. A. Cushman of a wasp found by Dr. Luis F. Martorell on flowers of "corcho" (*Pisonia albida*) on the Carmelita trail, Mona Island on April 2nd, 1940.

Enicospilus angulatus, described as an *Eremotylus* by Dr. C. W. Hooker (1912-144), the type from Mayagüez, was subsequently reared by Mr. R. H. Van Zwaluwenburg from the larva of *Ecpantheria icasia* (Cramer), and listed by him (P. R. 5037).

Enicospilus arcuatus (Felt) was the identification received by Mr. S. S. Crossman of an Ichneumonid wasp which he had collected at Aibonito.

Enicospilus concolor (Cresson), listed by Van Zwaluwenburg (P. R. 1028) from Mayagüez, has since been swept from grass at Río Piedras, and intercepted at light at Bayamón, and resting on lime at Dorado.

Enicospilus flaviceps (Brullé) was intercepted at light at Bayamón.

Enicospilus flavus (F.), was noted by Dr. Gundlach as "común," and listed by Dr. Stahl as on *Ophion*, and by Mr. R. H. Van Zwaluwenburg as P. R. 1027.

Enicospilus purgatus (Say) is in Van Zwaluwenburg's list as P. R. 1029.

Enicospilus thoracicus (Cresson), listed from Puerto Rico by Dr. Gundlach as an *Ophion*, was reared from the tobacco hornworm, *Phlegethontius sexta jamaicensis* Butler, by Mr. R. H. Van Zwaluwenburg, and listed by him as P. R. 5083.

CYNIPOIDEA: Figitidae

Long before the intensive investigation on fruitflies had been initiated by the Bureau of Entomology & Plant Quarantine in Puerto Rico, Dr. C. W. Hooker (1913-36) had reared a previously unknown Figitid wasp from the larvae of what he referred to as *Anastrepha fraterculus* Wied., now called *Anastrepha mombinpraeoptans* Seín, in the fruit of "jobo" or hog plum (*Spondias mombin*). In the same year, this wasp was included by Mr. J. C. Crawford in his "Descriptions of New Hymenoptera" (Proc. U. S. National Museum, **45** (6): 241–260. Washington, D. C., May 22, 1913) as **Ganaspis hookeri**. It is not very abundant, and presumably is a very minor factor in the control of fruitflies, but has since been reared from their maggots in oranges, and from those in the much smaller fruit of an imported tree, *Euphoria didyma*.

Eucoila (Hexamerocera) atriceps Ashmead, and, as determined by Mr. L. H. Weld, another species of this genus, are somewhat more abundant as parasites of both *Anastrepha mombinpraeoptans* Seín and *Anastrepha suspensa* Loew maggots, having been reared from fruit of "jobo" and of "pomarrosa" (*Eugenia jambos*) collected at Mayagüez, Las Vegas, San Sebastián, Caguas and Loíza. They have also been reared from cornsilk maggots, *Euxesta stigmatias* Loew.

Xyalosema (Aspicera) bifoveolata Cresson, as identified by Mr. J. C. Crawford, was reared by Mr. G. B. Merrill at Guánica from hornfly puparia when he was investigating possible natural factors in the control of this accidentally introduced pest. This wasp was originally described from Cuba, possibly before the horn fly had been introduced there, as "black; antennae and legs honey-yellow; wings hyaline, scutellar spine acute; length 1 line" from a single specimen collected by Dr. Gundlach. Dr. Gundlach did not find it in Puerto Rico, or at least left no record of collecting it here.

CHALCIDOIDEA: Agaonidae

In California, where commercial varieties of fig trees grow well, no fruit was produced on the thriving trees until the fig wasp, *Blastophaga psenes*

(L.), was introduced from Smyrna in 1890. Upon the presence of this minute wasp, the entire commercial Smyrna fig industry of California depends, as is told in detail by Dr. I. J. Condit in "Caprifigs and Caprification" (Bulletin No. 319, California Agr. Expt. Station, 1920). No such importations would be necessary into Puerto Rico to ensure the setting of fig fruit, for two species of Agaonid fig wasps are already present here. **Blastophaga insularis** Ashmead and **Secundeisenia mexicana** Ashmead, as identified by Mr. A. B. Gahan, have been intercepted on trees of wild fig or "jagüey" (*Ficus laevigata*) between Manatí, Ciales and Arecibo. It may be presumed that these wasps are present thruout the Island, and also that they or other species ensure the fertilization of the large hollow fruit of the climbing fig (*Ficus pumila*) or the smaller but much numerous fruits of the "laurel de la India" (*Ficus nitida*), altho none has been noted on these other figs.

Mymaridae

Anagrus armatus Ashmead, as determined by Mr. A. A. Girault, is a very small Mymarid wasp which is parasitic on the eggs of *Delphax saccharivora* Westwood, the sugar-cane "fly" which is really a Fulgorid planthopper. This is at times a very serious pest of sugar-cane in Jamaica and Barbados, feeding on the underside of young leaves, and sometimes so abundant as to kill out young cane and render replanting impossible. In Puerto Rico outbreaks are unknown, altho the planthopper occurs in small numbers in cane fields in all parts of the Island. Its continued scarcity is due, in part at least, to natural control by this insignificant wasp. The parasitic wasp also attacks the egg-masses of other leafhoppers in grasses, but recent rearings have not been made to determine the specific identity of its alternate hosts.

The wasp reared by Mr. A. S. Mills from some insect occurring on *Pluchea purpurascens* at Pt. Cangrejos has been identified by Mr. A. B. Gahan as a new species of **Polynema**.

Alaptus borinquensis, reared by Dr. H. L. Dozier from the pustule scale, *Asterolecanium pustulans* (Cockerell), on "caña fístula" (*Cassa fistula*), was included in his "Description of New Mymarid Egg Parasites from Haiti and Puerto Rico" (Jour. Dept. Agr. P. R., **16** (2): 81–91. San Juan, April 1932): "a very variable species in size; general color dark brown, the antennae and legs light brown, the pedicel slightly paler."

Alaptus caecillii Girault was determined by Mr. C. F. W. Muesebeck over twenty years after it had been reared by Mr. Thos. H. Jones from what he considered to be a Psocid egg-mass on sugar-cane.

Mymar antillanum, included by Dr. H. L. Dozier in his "Descriptions of miscellaneous Chalcidoid Parasites from Puerto Rico (Hymenoptera)"

(Jour. Agr. Univ. P. R., **21** (2): 121–135. San Juan, April 1937), the type female collected by him "sweeping grasses and sedges at roadside pond edge near Boquerón," is not confined to the semiarid southwestern corner of the Island, for altho others were found on the margin of Guánica Lagoon, he made additional collections of this dark brown wasp at Mayagüez and at 1,000 feet elevation in a coffee grove at Las Vegas.

Gonatocerus portoricensis Dozier (1937-131) may be "distinguished at once by its yellowish-orange abdomen, transversely banded with brown," the type from Isabela, but other specimens were found by Dr. Dozier at numerous points on the western and southern coast of Puerto Rico.

Gonatocerus antillensis Dozier (1937-132) was described from females collected at Mayagüez or nearby.

Erythmelus longicornis Dozier (1937-133) may be "recognized easily by the unusually long antennae and the pale, dirty yellowish legs": the type a single female from Maní beach near Mayagüez.

Erythmelus miridiphagus Dozier (1937-133) has "shorter antennae, fuscous legs", and was found in large numbers in a pure stand of *Amaranthus* heavily infested with Mirid bugs: *Polymerus cuneatus* Distant, at Hormigueros.

Erythmelus nanus Dozier (1937-134) is a short, compact wasp, mostly black but with the "basal third of the abdomen whitish", the type from Las Vegas, others from Guanajibo.

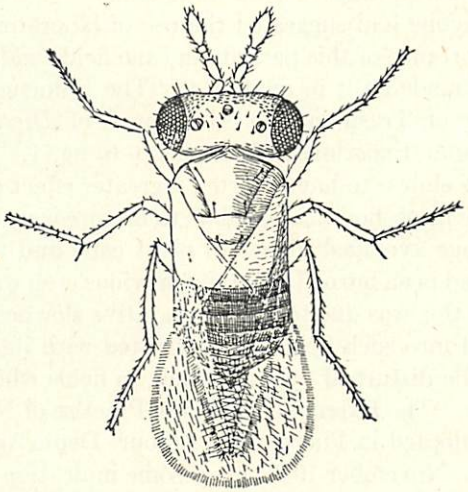
Trichogrammidae

Trichogramma minutum (Riley), a minute little yellowish wasp with pink eyes and brownish abdomen, a tropicosmopolitan parasite on the eggs of many kinds of butterflies and moths, is possibly best known in Puerto Rico because it attacks the eggs of the sugar-cane moth stalk-borer, *Diatraea saccharalis* (F.). Altho almost microscopic in size, it is readily visible against the creamy yellow of the moth-borer egg-cluster, where it has repeatedly been observed in the field. Eggs turn black the next day after they have been parasitized, and continue to be dark even after the parasites have emerged, usually about two weeks later. Each *Diatraea* egg contains sufficient nourishment for the complete development to adult of one parasite wasp.

In Puerto Rico, *Trichogramma* has been reared not only from the somewhat similar eggs of *Etiella zinckenella* (Treitschke) and *Psara periusalis* (Walker), but also from the skipper butterfly eggs of the canna leaf-roller, *Calpodes ethlius ethlius* (Cramer), and from other skipper butterfly eggs on sugar-cane. The possibility of producing large quantities of these parasites in the laboratory, however, depends upon the ease with which *Trichogramma* may be reared on the eggs of the Angoumois grain moth, *Sitotroga*

cereallela (Olivier), and these loose eggs glued to a cardboard sheet, paper cup or glass jar, for transportation to the cane field just as the parasites are about to emerge. The ability thus to control a laboratory-reared supply of parasites for release when and where needed seems to indicate a really practical method of using natural parasites as effectively for pest control as one might apply poisonous insecticides by means of a spray pump.

Extensive experiments with field liberations indicate that many unexpected difficulties limit such practical applications. "Natural Parasitism by *Trichogramma minutum* in the Eggs of the Sugar-Cane Moth Borer, *Diatraea saccharalis*, in the Cane Fields of Puerto Rico" (Jour. Agr. Univ. P. R., **27** (2): 39–83, fig. 1, pl. 6, ref. 14. Río Piedras, April 1942) is nor-



Trichogramma minutum (Riley), eighty-five times natural size. (Drawn by G. N. Wolcott.)

mally high during all the warmer part of the year, especially in ratoon fields in which the trash has not been burned, and in the more humid parts of the Island. In the eastern end of Puerto Rico, egg-clusters of *Diatraea* so rarely occur in abundance that the parasite continues existence most precariously, and nothing is to be gained by releasing additional parasites. Even in the most xerophytic parts of the Island, most fields of gran cultura cane have an abundance of egg-clusters, and also of parasites during the coolest part of the year. But especially in the Santa Isabel region, and to a lesser extent all along the south coast, the cooler temperatures of late fall, winter and early spring seem to eliminate *Trichogramma* from some fields of plant cane, and in these fields the release of laboratory-reared parasites is beneficial. Regardless of the reason why the parasites did not naturally

occur in a particular cane field, if unparasitized egg-clusters were present in abundance, the laboratory-reared parasites promptly attacked them, often making their artificial parasitization as high or higher than in other fields in the region where no parasites had been released. Thus the problem of using *Trichogramma* effectively is resolved into that of finding promptly these fields where fresh egg-clusters are abundant but little or no natural parasitism occurs. Any other method of using *Trichogramma*, by mass releases in *all* fields at the seasons and in the regions where only a few fields are deficient in parasites, involves a very considerable waste of the parasites, even tho it is possibly the most practical, and indeed has been adopted in other countries where this method of control of the sugar-cane moth-borer has been attempted on a large scale.

Long before anyone had suggested the use of laboratory-reared *Trichogramma*, the importance of this parasite in cane fields had been recognized, and observations made on it in relation to "The Influence of Rainfall and the Non-Burning of Trash on the Abundance of *Diatraea saccharalis*" (Circ. No. 7, Insular Experiment Station, pp. 6, fig. 1. San Juan 1915). While rainfall was shown to have exerted a greater effect on the amount of damage caused by moth-borer caterpillars to mature cane stalks as brought to the mill, damage averaged higher to plant cane and to ratoon cane of which the trash had been burned when the previous crop was harvested. It was thought that this was due to the comparative slowness with which the parasite dispersed into such fields, as contrasted with its normal presence in abundance, little disturbed by harvesting, in fields where the trash had not been burned. "The Extent to which the Practise of Not Burning Cane Trash has been adopted in Puerto Rico" (Jour. Dept. Agr. P. R., **17** (3): 197–8. San Juan, November 1933) gives some indication of how the benefits of having an abundance of *Trichogramma* naturally present in cane fields may be obtained, at least in part, without the expenditure of time and money involved in the use of laboratory-reared parasites, merely by the adoption of the field practise of not burning trash.

Xenufens ruskini Girault, as determined by Mr. A. B. Gahan, is another Trichogrammid parasite of the eggs of skipper butterflies on sugar-cane, in addition to *Trichogramma minutum*. As a result of the combined attack of these two Trichogrammid wasps, plus that of an Encyrtid wasp which was described by Mr. Gahan (1944-137) under the name of *Oöencyrtus prenidis*, "from October to February, when eggs are most numerous, two-thirds or more of all eggs collected are black with parasitism, and all of the smaller number of eggs during the summer are parasitized." In making observations on "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields" (Jour. Agr. Univ. P. R., **27** (2): 85–104, fig. 12, ref. 16. Río

Piedras, April 1942) "not a single caterpillar was noted from April to September" during the five years in which the leaves of young plant and ratoon cane were watched: surely a most effective demonstration of how potentially serious pests may be kept to a minimum by natural parasite control.

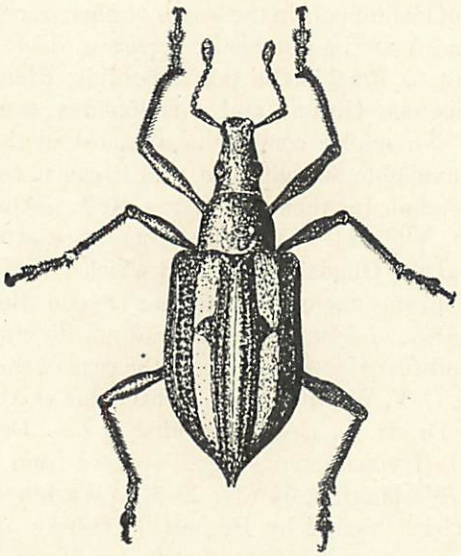
Poropoea attelaborum Girault, as determined by Mr. A. B. Gahan, is a small black wasp which attacks the egg of guava leaf-roller, *Euscelus bipustulosus* Jekel, despite the supposed protection under several layers of rolled-up leaf. Apparently it is an important factor in limiting the abundance of this most interesting beetle.

From the eggs of leafhoppers in the leaves of sugar-cane and other grasses, Mr. Thos. H. Jones reared a number of parasites which were identified by Mr. A. A. Girault as **Brachistella prima** Perkins, **Ufens niger** Ashmead, **Oligosita comosipennis** Girault and **Aphelinoidea semifuscipennis** var. **albipes** Girault. No similar competent specialist in the identification of leafhoppers was available at that time, and it can merely be conjectured that the host was what was then known as a *Kolla* or *Cicadella*, now called *Hortensia similis* (Walker). Nor has anyone since attempted such large scale rearings, and the **Oligosita magnifica** which Dr. H. L. Dozier (1937-135) described from specimens at Cartagena Lagoon, Boquerón and Bayamón, was not reared, and its host is unknown. Twenty years after Mr. Thos. H. Jones had reared a parasite from the eggs of the common *Ormenis* planthopper, Mr. C. F. W. Muesebeck identified it as a species of **Abbella.**

Ufens osborni Dr. H. L. Dozier included in his "Descriptions of New Trichogrammatid (Hymenoptera) Egg Parasites from the West Indies" (Proc. Ent. Soc. Washington, **34** (3): 29–37. Washington, D. C., March 1932), from material "reared by Herbert T. Osborn at Central Aguirre, P. R., in 1930 from the eggs of the Sugar Cane Root Weevil, *Diaprepes abbreviatus* L." It is apparently only a secondary parasite, attacking eggs previously parasitized by *Tetrastichus haitiensis* Gahan. Even thru the surrounding egg-shell of the host one can plainly see the pink eyes and yellow body of the parasite, very different from the black of the primary parasite. The evidence regarding whether *Ufens osborni* is a primary or secondary parasite is, however, somewhat conflicting, but before any such doubts arose, Mr. R. W. E. Tucker attempted, unsuccessfully, to introduce it into Barbados. According to Mr. R. G. Fennah, who conducted "The Citrus Pests Investigation in the Windward & Leeward Islands, British West Indies, 1937–1942" (pp. 66, pl. 2, ref. 20. Imperial College of Tropical Agriculture, Trinidad, August 1942), *Ufens osborni* occurs in Montserrat, but other species of *Ufens*, differing markedly from each other, occur in Dominica and St. Lucia, both of which he considers primary parasites of *Diaprepes* eggs, but competitive with *Tetrastichus haitiensis*.

Tetrastichidae

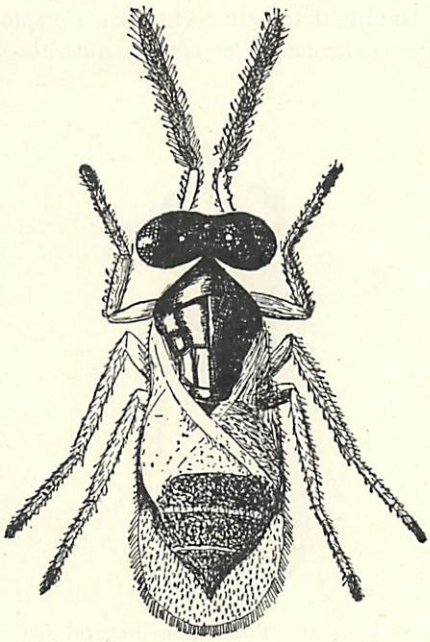
The common large leaf weevil of Hispaniola, black with pink or yellow stripes on the elytra, *Prepodes quadrivittatus* Olivier, is often as abundant there as *Diaprepes abbreviata* (L.) is in Puerto Rico, and is its perfect analogue in the number and variety of hosts, the leaves of which it will eat and between which it oviposits. When life-history studies on it were commenced, most of the egg-clusters between citrus leaves were found to be parasitized, the wasps emerging thru the holes which they make in the



Prepodes quadrivittatus Olivier, the Hispaniolan Weevil from whose eggs *Tetrastichus haitiensis* Gahan was reared. Twice natural size. (Drawn by Fritz Maximilien.)

leaves being promptly described by Mr. A. B. Gahan (Proc. Ent. Soc. Washington, **31** (1): 17. Washington, D. C. January 1929) as **Tetrastichus haitiensis.** It seems incredible that these parasitic wasps had not previously been found in Puerto Rico, where they are so abundant in late spring as to form an appreciable item in the food of arboreal lizards, and are in fact the principal factor in the control of the vaquita, *Diaprepes abbrevita* (L.). They are so numerous indeed during April, May and June, when most *Diaprepes* eggs are laid, that practically all egg-clusters are parasitized at that time. The female vaquitas begin oviposition between the tougher and older leaves of preferred host trees within a few days after their emergence from their pupal cell in the soil, thus survival of *Diaprepes* largely depends upon the egg-clusters laid at other times of year, when the

parasites are scarce. Thus, "deviation from a one-year life-cycle is of tremendous value to *Diaprepes abbreviatus* L., in enabling its eggs to escape attack by the parasitic wasp, *Tetrastichus haitiensis* Gahan, which is most abundant during the late spring, but very scarce during autumn and winter," as was shown in studies on "The Life-History of *Diaprepes abbreviatus* L., at Río Piedras, P. R." (Jour. Agr. Univ. P. R., **20** (4): 883–914, fig. 5, ref. 21. Río Piedras, October 1936).



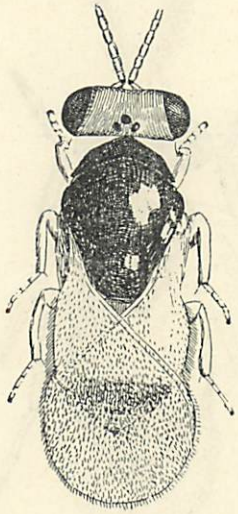
Tetrastichus haitiensis Gahan. Sixty times natural size. (Drawn by G. N. Wolcott.)

In Cuba, *Testrastichus haitiensis* and *Ufens osborni* have been reared from the eggs of the "verde-azul," *Pachnaeus litus* (Germar). In the Lesser Antilles, eggs of the endemic species of *Diaprepes* are attacked. In Barbados, however, *Tetrastichus haitiensis* does not occur, and an attempt was made to introduce it there. The ostensible cause of failure was the difficulty experienced by the wasps in piercing the tough tips of cane leaves, where only do the Barbadian weevils lay their eggs. Parasitized egg-clusters have been found between the tips of cane leaves in Puerto Rico, but so rarely as to indicate that a real protection to the eggs is thus afforded, not furnished by tender citrus or wild fig leaves.

Tetrastichus vaquitarum Wolcott ("IP" 1923–63), reared from the eggs

of the coffee vaquita, *Lachnopus coffeae* Marshall at Indiera, in the high mountains between Yauco and Maricao in June 1921, is very different in appearance from the all black wasps attacking the eggs of the larger vaquitas, for it has a yellow head with chestnut red ocelli and eyes. No collection, subsequent to that of the type, has been made in Puerto Rico, or elsewhere.

Tetrastichus hagenowi (Ratzeburg), originally indentified from Puerto Rico by Mr. J. C. Crawford, has been repeatedly reared from tough leathery oöthecas of the big domestic cockroach, *Periplaneta americana* L. The similar Australian cockroach, *Periplaneta australasiae* (F.), is "para-



Tetrastichus vaquitarum Wolcott. Fifty times natural size. (Drawn by G. N. Wolcott.)

site-free", according to Mr. H. K. Plank (1947-12). The very tough and sticky glue used by vaquita weevils to cement together two leaves over their egg-clusters fails to prevent parasitism, as does the even harder leathery covering of the cockroach egg-mass, from this small wasp and the large black Evaniid wasps, as previously noted. From a single cockroach egg-capsule, laid in captivity, 71 adults of these smaller wasps emerged, indicating that several must have developed in each cockroach egg, and also proving that this is, or may be, a primary parasite.

Tetrastichus periplanetae Crawford, as identified by Mr. A. B. Gahan, has also been reared from the egg-capsule of a domestic cockroach. Both of these cockroach parasites have been collected in the field, as well as around kitchens and garages infested with cockroaches.

Tetrastichus tatei is the name given by Dr. H. L. Dozier (1937-129),

re-describing **Tetrastichus thripophonus** Waterston of Trinidad, to the wasps he reared "from swollen last instar nymphs of *Gynaikothrips uzeli* (Zimm.) curling the foliage of Cuban laurel, *Ficus nitida*, on the Experiment Station grounds at Mayagüez, P. R., March 26–April 5, 1936." The males of this parasite are unknown, but the females, slightly over 1.0 mm. in length are "dark brown in color, the eyes conspicuously red, with the antennae and legs yellowish-testaceous, and a light or clear median area occupying over a third of the abdomen at base." The synonymy of this thrips parasite, now known to occur also in Florida, is pointed out by Dr. B. D. Burks in his paper on "The North American Parasitic Wasps of the Genus *Tetrastichus*—A Contribution to Biological Control of Insect Pests" (Proc. U. S. National Museum, **93** (3170): 505–608, pl. 6. Washington, D. C., 1943), who notes that it has been reared also from prepupae of *Liothrips laureli* (Mason) and *Liothrips urichi* Karny, as well as from what is now known as *Gynaikothrips ficorum* Marchal.

"During the spring of 1940 while residing at Río Piedras," Prof. James G. Needham became very much interested in the "Insects from Seed Pods of the Primrose Willow, *Jussiaea angustifolia*" (Proc. Ent. Soc. Washington, **43** (1): 2–6, fig. 1. Washington, D. C., January 1941), and from cages containing galls caused by *Ceratoneura femorata* (Ashmead) took a male and a female of **Tetrastichus marylandensis** (Girault). This species, whose "body is usually almost entirely yellow" had previously been recorded from Puerto Rico by Dr. F. M. Wadley in his "Observations on some Insects associated with Sugarcane in Puerto Rico" (Jour. Agr. Univ. P. R., **21** (2): 103–114, ref. 15. Río Piedras, April 1937) as a parasite of the corn aphis, *Aphis maidis* Fitch. In the Lesser Antilles, Mr. R. G. Fennah (1942-15) found this species attacking the eggs of the endemic species of *Diaprepes*, and noted that "in *Tetrastichus marylandensis* it seems more usual for the larvae to eat their way out of the *Diaprepes* egg when ready to pupate, and to take a position at right angles to the periphery of the former egg-cluster. Thus the pupae are grouped radially, sometimes in perfect formation."

Tetrastichus antiguensis Crawford, as doubtfully identified by Mr. C. F. W. Muesebeck, was reared by Mr. Thos. H. Jones from the leaves of *Piper* sp. infested with larvae of the leaf-miner, *Tischeria heliopsisella* Chambers, on El Yunque.

Other species of *Tetrastichus*, unidentified as to species, have been reared from material of the coffee leaf-miner, *Leucoptera coffeella* (Guérin-Méneville); from galls on "corcho" (*Torrubia fragrans*) at Isabela, and on "laurel blanco" (*Nectandra sintenisii*) at Patillas by Dr. Luis F. Martorell; from the fruit of *Casearia decandra* intercepted at Vega Alta; besides one which Mr. J. A. Ramos collected at light on Mona Island.

Syntomosphyrum species is the determination by Mr. A. B. Gahan of

hyperparasitic wasps emerging from *Apanteles* cocoons on the larvae of a leafwebber, *Phostria martyralis* (Lederer), collected by Dr. Luis F. Martorell on "genogeno" (*Lonchocarpus domingensis*) at Guayanilla.

Ceratoneura femorata (Ashmead), which Prof. James G. Needham (1941–4) reared from galls of the primrose willow, is the only phytophagous, gall-producing Eulophid known from Puerto Rico. Mr. A. B. Gahan (Proc. Ent. Soc. Washington, **43** (1): 1–2. Washington, D. C., January 1941) states that this species was originally described from the island of St. Vincent as a *Tetrastichodes*, with no indication as to its habits.

Ceratoneura petiola Ashmead, as determined by Mr. C. F. W. Muesebeck, was reared by Mr. Thos. H. Jones from a little weevil in portulaca which Dr. E. A. Schwarz had doubtfully identified as a species of *Hypocoeliodes*, or possibly *Hypurus*, near *bertrandi* Perris.

Entedontidae

Chrysocharis parksi Crawford, as determined by Mr. C. F. W. Muesebeck, has been repeatedly reared from the larvae of the Agromyzid leaf-miner of peas and beans, and another species of *Chrysocharis* has been reared (Anon. 1939-108) from the larvae of the Pyralid leafwebber of beans, *Lamprosema indicata* (F.).

Chrysocharis lividus Ashmead was first reared as a parasite of the coffee leaf-miner, *Leucoptera coffeella* (Guérin-Méneville), by Mr. O. W. Barrett, the first Entomologist at the Mayagüez Station. This wasp he described (*in* Annual Report P. R. Agr. Expt. Station for 1904, p. 397. Washington, D. C., 1905) as being "black with purplish reflections from the thorax; the size about 1.0 mm.; very active," and by the next year found that it was common "throughout the island." Mr. Francisco Seín has painted, approximately five hundred times life size, representations in color of both the male and female of this wasp, which well indicate how different in appearance are the two sexes. The wasps are black only on the basal segments of the legs, but the tarsi and tips of the tibiae are white. The female is much plumper, being various shades of orchid and purple, the slender male is mostly greenish, the basal half of the abdomen being transparent and startlingly lighter in color. This parasite of the coffee leaf-miner does occur everywhere on the Island that coffee is grown, but it is much more abundant at Mayagüez, where Mr. R. H. Van Zwaluwenburg in 1933 found thirty percent of parasitism, than at higher elevations only a few miles away, where barely one percent of the leaf-miner larvae may be attacked.

The intensive rearing by Mr. Francisco Seín of the coffee leaf-miner indicates that *Chrysocharis lividus* is only one out of many attacking it in Puerto Rico. Of the less common parasites, Mr. A. B. Gahan has identi-

fied **Proacrias coffeae** Ihering, a species of **Derostenus** "near *fullawayi* Crawford," and a species of **Closterocerus** "near *cinctipennis* Ashmead."

The green **Closterocerus leucopus** Ashmead proves to be one of the most abundant parasites generally, especially in the mountains.

Horismenus cupreus Ashmead, a plump, iridescent coppery-green wasp with red eyes, and legs black except for white tarsi and white ends of the tibiae, is possibly third in abundance in the mountains. Of it, Mr. Seín has made a five hundred times life-size painting in color.

Horismenus eudami (Girault), in Cuba reared as a hyperparasite of *Apanteles leucostigmus* Ashmead, attacking the bean leaf-roller, a skipper butterfly formerly called *Eudamus*, but now *Urbanus proteus* (L.), has been reared from these caterpillars in Puerto Rico with no indication that it is not a primary parasite. Dr. L. O. Howard himself identified the material, which had been reared by Dr. Richard T. Cotton.

Another species of **Horismenus,** not identified as to species, has been reared from cocoons of *Apanteles americanus* (Lepeletier) intercepted at Vega Alta.

From vaquita egg-clusters parasitized by *Tetrastichus haitiensis* Gahan, a hyperparasite has been reared, identified by Mr. A. B. Gahan as another species of **Horismenus,** "very similar to (*Pseudomphale*) *graciliventris* (Girault)."

From pods of *Prosopis juliflora* and *Acacia farnesiana* infested with the Bruchid beetle, *Amblycerus martorelli* Bridwell, another **Horismenus** has been reared.

Horismenus apantelivorus Crawford, as determined by Mr. A. B. Gahan, has been found in a cage containing *Pluchea purpurascens* intercepted at Pt. Cangrejos, and also a new species of **Euderus.**

This, or another species of **Euderus** Mr. Francisco Seín found to be a minor parasite of the pepper flower-bud moth, *Gnorimoschema gudmanella* (Walsingham).

Of the "Two Undescribed Chalcid Parasites of the Woolly White Fly, *Aleurothrixus floccosus* (Maskell) from Haiti" (Proc. Ent. Soc. Washington, **34** (7): 118–122. Washington, D. C., October 1932) reared by Dr. H. L. Dozier, a single female "from the same host on lignum-vitae at Central Aguirre, P. R., June 28, 1925 is undoubtedly the same species but the general color is a shade deeper" and proves to be his **Euderomphale aleurothrixi.**

Eulophidae

From seed of the economically important forest tree "aceitillo" or satinwood (*Zanthoxylum flavum*), infested with its specific and normally very abundant enemy, the weevil *Apion martinezi* Marshall, a Eulophid wasp

has been reared which Mr. A. B. Gahan states to be a new species of **Emersonopsis.**

Diaulinus insularis, described by Mr. A. B. Gahan (Proc. U. S. National Museum, **48:** 165. Washington, D. C., December 16, 1914) from material reared by Dr. Richard T. Cotton from *Agromyza inaequalis* Malloch, has since been reared from *Agromyza pusilla* Meigen in "cohitre" (*Commelina longicaulis*) intercepted at Humacao.

Possibly the most interesting Eulophid now present in Puerto Rico is one originally described from Java, of which Mr. S. M. Dohanian, in his account of the "Life-History of the Thrips Parasite, **Dasyscapus parvipennis** Gahan, and the Technic for Breeding it," (Jour. Ec. Ent., **30** (1): 78–80, ref. 6. Menasha, February 1937) tells of its subsequent discovery on the Gold Coast of Africa, and of its importation and establishment in Trinidad, whence he made shipments to Puerto Rico. Because the cacao growers of Trinidad were primarily interested in natural means of control of their cacao thrips, *Selenopthrips rubrocinctus* (Giard), most observations have been made of parasitism on this host, but as Mr. Dohanian points out, "evidently it is not fastidious as regards hosts." Economically it is of little importance because it becomes sufficiently abundant to destroy many thrips only during wet weather, when thrips are least numerous, and the injury they then cause is negligible.

Spalangidae

Spalangia muscidarum Richardson, as identified by Mr. A. B. Gahan, was first reared from pupae of the horn fly, *Siphona irritans* (L.), in Puerto Rico by Mr. G. B. Merrill, at Guánica. This wasp never becomes sufficiently abundant to be more than a minor factor in control, altho in some cases as many as a third of the puparia are found parasitized.

Spalangia haematobiae Ashmead, a much less abundant horn fly parasite in Puerto Rico, was recorded by Dr. H. L. Dozier.

Spalangia drosophilae Ashmead, as determined by Mr. A. B. Gahan, was reared from horn fly puparia by Dr. Kenneth A. Bartlett, as is reported in his account of "The Introduction into Puerto Rico of Beneficial Insects to aid in the Control of the Horn Fly of Cattle" (Agr. Notes No. 88, pp. 6. Mayaguez, March 31, 1939).

Spalangia philippinensis Fullaway is an introduced parasite of horn fly puparia, brought from Hawaii, reared in captivity in Puerto Rico and, four months after release at Juana Díaz, recovered in the field by Dr. Bartlett (1939-5). "This parasite is not specific in its habits and is known to attack dipterous puparia in general. In the laboratory it was successfully reared on six species of Diptera, (but) by far the best results were obtained when puparia of the housefly and stablefly, *Musca domestica* and *Stomoxys*

calcitrans, were used". From Puerto Rico, material of this parasite (Anon. 1941-71) was sent to Colombia.

Pteromalidae

Muscidifurax raptor Girault & Sanders, as determined by Mr. A. B. Gahan, is another parasite of horn fly puparia that was found by Dr. K. A. Bartlett (1939-6) to be present in Puerto Rico.

Pachycrepoideus dubius Ashmead, as identified by Mr. C. F. W. Muesebeck, has also been reared in small numbers by Dr. Bartlett (1939-6) from horn fly puparia.

Neocatolaccus livii, described Mr. A. A. Girault (Insecutor Inscitiae Menstruus, **4**: 111. Washington, D. C., 1916) from type material reared by Mr. Thos. H. Jones, is a small Pteromalid parasitizing *Ctenodactylomyia watsoni* Felt, the Cecidomyid fly which makes galls in the leaves of sea-grape, *Coccoloba uvifera*.

Neocatolaccus filia is one of Mr. Girault's MS names for the wasps reared by Dr. Richard T. Cotton from the seeds of morning glory infested with puparia of *Agromyza caerulia* Malloch, and is similar to those from Agromyzid material present in the seeds of *Sida rhombifolia*.

Neocatolaccus sp. nov., as identified by Mr. A. B. Gahan, was reared from a puparium of the Syrphid fly *Baccha capitata* Loew on the branch of a "capá blanco" tree at San Sebastián by Dr. Luis F. Martorell.

Pachyneuron allograptae Ashmead is a blue-green Pteromalid wasp which has repeatedly been reared from Syrphid fly puparia, not only in Puerto Rico, but also on Mona Island, determinations having been made by Mr. A. B. Gahan. In every case, the parasites were 100% effective in control, so that the specific identity of the host is uncertain. Indeed, Mr. L. Courtney Fife (1939-9) found this parasite so abundant that "the control of *Aphis gossypii* effected by *Baccha clavata* was to a large extent annulled."

Pachyneuron eros Girault, as identified by Mr. C. F. W. Muesebeck, has been reared from mealybugs, most recently from *Phenacoccus gosspyii* Townsend & Cockerell, a serious mealybug pest at times on the ornamental *Acalypha wilkesiana*.

Pachyneuron siphonophorae Ashmead, as identified by Mr. C. F. W. Muesebeck, has repeatedly been reared from various species of aphids, first in Puerto Rico by Mr. Thos. H. Jones from *Aphis gossypii* Glover on okra, and reported by Dr. F. M. Wadley (1937-106) from *Sipha flava* Forbes and *Hysteroneura setariae* Thomas on sugar-cane.

Aplastomorpha calandrae (Howard) was noted, as a *Pteromalus*, by Mr. O. W. Barrett (1905-396) as "a common parasite of the rice weevil, *Calandra oryzae*," but the only subsequent record is of finding adults resting on cane leaves in a field at Salinas.

Zatropis deuterus Crawford, as identified by Mr. A. B. Gahan, was intercepted at Bayamón, resting on the leaves of a guava bush.

From the material of *Pluchea purpurascens* intercepted by Mr. A. S. Mills at Pt. Cangrejos, some small Pteromalid wasps emerged which Mr. A. B. Gahan doubtfully identifies as being a species of **Pteromalus.**

Elachertidae

At least three undescribed species of **Elachertus** occur in Puerto Rico. Possibly most abundant is that one, dark brown in color, with very conspicuous black eyes, which Dr. Luis F. Martorell reared from dead parasitized larvae of the "roble" and gourd Pyralid, *Eulepte concordalis* Hübner, at San Sebastián and at Yabucoa. Eight or ten greyish maggots emerged from each caterpillar, and by next day had transformed to naked, light brown pupae, from which adults emerged less than a week later. Another *Elachertus*, black in color, is a rather rare parasite on the Gracilariid leaf-miner, *Phyllonorycter* sp. nov., in potted insecticidal plants of *Tephrosia toxicaria* and *Tephrosia vogelii* at the Mayagüez Station, as noted in the Annual Report for 1939, p. 115. The third *Elachertus*, as identified by Mr. A. B. Gahan, is a brownish wasp which Mr. Francisco Seín reared in small numbers from coffee leaves infested with leaf-miners, *Leucoptera coffeella* (Guérin-Méneville).

A somewhat more slender yellowish-brown wasp with pink eyes and a dark spot on the distal half of the forewing, identified by Mr. A. B. Gahan as a new species of **Cirrospiloideus**, is an almost equally scarce parasite of the coffee leaf-miner in the mountains of Puerto Rico.

Besides these two less common parasites, Mr. O. W. Barrett (1906-22) reared what Dr. Ashmead identified as his *Zagrammosoma multilineata*, a "rare parasite, strictly primary." In Mr. Seín's rearings from Lares, Quebradillas and Isabela, wasps corresponding to this have been obtained which are quite different in details from Ashmead's species. Under the name **Zagrammosoma seini** Wolcott ("IB" 1936-525) they have been characterized as slender, "honey yellow wasps with median and dorsolateral black stripes on the thorax, the latter normally becoming broader on the abdomen, the other fainter and interrupted, but some specimens have the abdomen banded with black," the eyes salmon in color.

Dr. L. O. Howard described two continental species of **Euplectrus,** both of which have been identified from Puerto Rico: **comstocki** and **plathypenae.** The stout, black female wasp, about 2 mm. long, lays clusters of from five to thirty eggs on the back or side of a partly grown caterpillar. The maggots, which hatch in three days, remain clustered together in a heap on the outside of the caterpillar: a greenish-white mass which increases so rapidly in size that in a few days it has emptied the skin of its host, the

individual maggots then dispersing only to spin loose flimsy cocoons beneath. Numerous such parasitized caterpillars, which could not be identified, were found on the leaves of the yellow caltrop, *Tribulus cistoides*, at Puerta de Tierra in 1934, but other records of attack on *Laphygma frugiperda* (Abbot & Smith), *Leucania latiuscula* (H. S.), *Xylomiges sunia* Guenée, *Pseudoplusia oo* (Cramer) and *Gonitis praerupta* (Möschler), indicate how varied, among the Noctuidae, are its hosts. Caterpillars of the Hispaniolan sugar-cane butterfly, *Calisto pulchella* Lathy, have repeatedly been found dead from attack by an *Euplectrus*, but no comparable attack on any butterfly caterpillar has been observed in Puerto Rico. *Euplectrus* is really not common, but the clusters of cocoons under the dead caterpillar skin are so conspicuous, resting on top of a leaf in plain sight, that few observations of occurrence have failed of being recorded.

Pachyscapha insularis Howard, as identified by Mr. C. F. W. Muesebeck, has been reared from larvae of the bean leaf-webber, *Lamprosema indicata* (F .).

Grotiusomyia nigricans (Howard) is reported by Mr. A. B. Gahan (Ann. Ent. Soc. America, **25** (4): 736–757. Columbus, 1932) as another parasite of the larvae of the bean leaf-webber, *Lamprosema indicata* (F.), intercepted on lima beans.

Ardalus antillarum, a slender black wasp with legs and basal half of abdomen whitish, was described by Mr. A. B. Gahan (Proc. U. S. National Museum, **61** (2445): Art. 24, p. 20. Washington, D. C., 1922) "from larvae of *Prenes nero* Fabricius, May 10, 1921" collected at Caguas, Puerto Rico. Mr. Thos. H. Jones had reared this parasite from the same host, now called *Panoquina*, in 1913, and noted that "the larvae issue from the caterpillars and form naked black pupae nearby, sixteen individuals having been observed to come from one large larva."

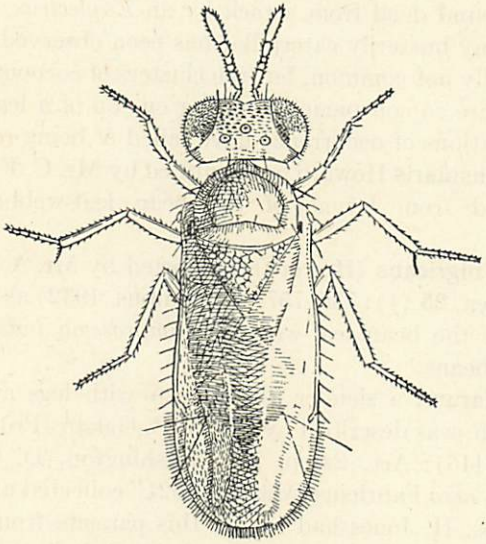
Elasmidae

Elasmus maculatus Howard, as determined by Mr. C. F. W. Muesebeck, has been reared from the cocoons of *Apanteles americanus* (Lepeletier) around the larvae of *Erinnyis ello* (L.) intercepted on yuca at Barceloneta

Aphelinidae

In most striking contrast to all the black, brown or iridescent purplish-bluish-green wasps is the pale, silvery green **Aphelinus (Aphytis) chrysomphali** Mercet, as determined by Mr. A. B. Gahan, most often to be seen on the underside of coconut palms infested with *Aspidiotus destructor* Signoret. It was first identified by Dr. L. O. Howard, as "apparently my *Aphelinus diaspidis*," but this most common Chalcid in the United States, Hawaii and Japan, described by Dr. E. O. Essing as "dull yellow through-

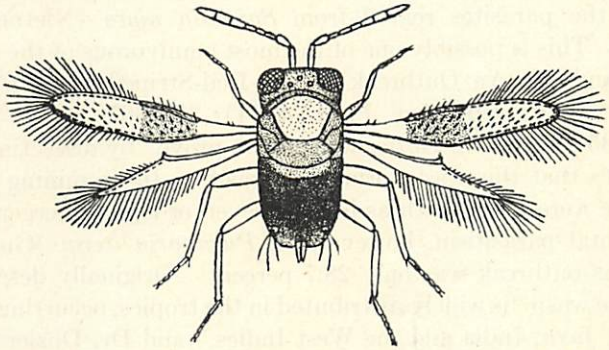
out," has not been found in Puerto Rico. By the circular holes in the back of so many scales, the extent of parasitism by this wasp in old scales may be estimated, and, of course, where many parasites have emerged from old scales, many of the younger ones may be presumed to be attacked, even if externally they give no indication. Until effective Coccinellid beetles were introduced into Puerto Rico, this wasp was the major, if ineffective, natural means of control of the coconut scale.



Aphelinus chrysomphali Mercet. Seventy times natural size. (Drawn by G. N. Wolcott.)

In one of the earliest attempts to ship beneficial insects from Puerto Rico, from parasitized scale insects on citrus branches collected at Mayagüez by Dr. C. W. Hooker and sent by him to California, the only parasite to emerge was **Aspidiotiphagus citrinus** Craw. Despite its original description from California material by Mr. Alex. Craw, this is a common endemic wasp in Puerto Rico, being also found in southern Europe, Brasil and the tropical Pacific Islands. Re-examining some of Craw's reared material, and comparing it with wasps reared in Puerto Rico from *Asterolecanium pustulans* (Cockerell), Dr. H. L. Dozier in his "Notes on Porto Rican Scale Parasites" (Jour. Dept. Agr. P. R., **10** (3 & 4): 267–277, fig. 11. San Juan, September 1927) prepared a new drawing of the wasp and pointed out such distinguishing characteristics as "head as wide as thorax", "the entire abdomen darkened", "the first joint of the club of the antennae almost as long as either of the apical two",

and "the submarginal vein always with two setae". The economic importance of this scale insect parasite is very considerable, altho rarely was it sufficiently abundant in commercial citrus groves so that spraying with oil emulsion was unnecessary. Two other parasites of *Asterolecanium pustulans* occur in Puerto Rico, and no studies have been made on their relative abundance, but, undisturbed by spraying or any other means of artificial control, they have been able to eliminate heavy infestations of pustule scale on "maga" (*Montezuma speciosissima*) and on the introduced *Sciacassia siamea* that threatened to kill the trees.



Aspidiotiphagus citrinus Craw. Greatly enlarged. (Drawn by H. L. Dozier.)

Aspidiotiphagus lounsburyi Berlese & Paoli, according to Dr. H. L. Dozier "readily distinguished from *Aspidiotiphagus citrinus* by its more yellowish color, the first joint of the club being only half the length of the second joint, and especially by having only a single seta on the submarginal vein", was reared by him from *Aspidiotus destructor* (Signoret) and from *Pseudaulacaspis pentagona* (Targioni). Mr. Thos. H. Jones had previously reared it from what at that time was called *Chionaspis citri* Comstock.

When the "Fish Hawk" brought Mr. Aug. Busck to Puerto Rico in 1899 with instructions to add to the record of the single scale insect known to exist there, he not only collected an abundance of scale insect material, but incidentally brought back to Washington some of their parasites.

Marietta busckii, described by Dr. L. O. Howard in his "New Genera and Species of Aphelininae" (U. S. Dept. Agr., Bur. Ent., Technical Series, **12** (4): 87. Washington, D. C., July 12, 1907) as a *Perrisopterus*, was "from *Asterolecanium aureum* Boisduval, collected at San Juan, P. R., February 21, 1899, by A. Busck". This wasp has subsequently been reared by Dr. H. L. Dozier from soft scale on citrus, from *Asterolecanium pustulans* (Cockerell) and from *Ceroplastes cirripediformis* Comstock.

Marietta pulchellus (Howard), as identified by Dr. H. L. Dozier, was reared from *Furcaspis biformis* (Cockerell) on maguey at Comerío. From material of *Saissetia nigra* (Nietner) recently sent to California, one of these wasps was reared.

Coccophagus scutellaris Dalman, reared by Dr. Stanley E. Flanders of California from material of *Saissetia nigra* (Nietner) from Puerto Rico, had previously been recorded under the name of *Coccophagus lunulatus* Howard by Dr. H. L. Dozier (1926-118) as being "an effective control of the soft brown scale, *Coccus hesperidum* L."

Aneristus ceroplastae Howard was identified by Dr. Stanley E. Flanders as one of the parasites reared from *Saissetia nigra* (Nietner) sent to California. This is possibly one of the most omnivorous of the scale insect parasites, and in "An Outbreak of the Red-Striped Sugar-Cane Scale" at Arecibo (Jour. Dept. Agr. P. R., **9** (4): 357–367, fig. 4. San Juan, October 1935), Dr. H. L. Dozier was able to prove "by dissecting the adult female scales that this was a primary parasite. In examining parasitized scales, some were found with as high as seven or eight emergence holes in them." Total parasitism, however, on *Pulvinaria iceryi* (Guérin-Méneville) in this outbreak was only 28.7 percent. Originally described from Jamaica, the wasp "is widely distributed in the tropics, occurring in Hawaii, Philippines, Java, India and the West Indies," and Dr. Dozier had reared it in Louisiana. In Puerto Rico he reared it from *Ceroplastes cirripediformis* Comstock, *Saissetia hemispherica* (Targioni) and *Eucalymnatus tessallatus* Signoret. Its "general color is black with slight purplish reflections, antennae dark brown with exception of the light colored scape." It "resembles greatly a *Coccophagus*, being distinguished. . .only by the shape and the structure of the posterior tibiae." The female averages 1.0 mm. in length, the males are somewhat smaller.

Pseudopteroptrix imitatrix Fullaway, originally described from Hawaii, is "an abundant parasite of *Howardia biclavis* (Comstock)" there, and in Puerto Rico has been reared from this host by Mr. Thos. H. Jones and Dr. H. L. Dozier, to which it is apparently restricted.

Prospaltella diaspidicola Silvestri, described from Italy as a parasite of *Pseudaulacaspis pentagona* (Targioni), has been reared from this host in South Africa, Japan and Brasil, and in small numbers by Dr. H. L. Dozier in Haiti and Puerto Rico. "Repeated rearing attempts in both Puerto Rico and Haiti failed to show the presence of *Prospaltella berlesei* Howard, and this useful parasite should be introduced." As suggested by Dr. Dozier, some of these parasites were eventually brought from Louisiana, as reported by Dr. K. A. Bartlett (Agr. Notes No. 85, Mayagüez, March 12, 1938), but apparently no attempt has been made to determine if this parasitic wasp became successfully established in Puerto Rico.

Prospaltella brunnea, described by Dr. L. O. Howard (Ann. Ent. Soc. America, **1:** 283. Columbus, 1908) from whitefly material collected by Mr. Aug. Busck at Bayamón in 1899, has not since been reared in Puerto Rico, but indicated that wasps of this genus are not confined to scale insects for hosts.

Prospaltella ciliata, described by A. B. Gahan (Proc. U. S. National Museum, **71** (2676) Art. 4: 1–39, pl. 1, fig. 3, ref. 8. Washington, D. C. 1927), is another whitefly parasite, having been reared from *Aleurodicus* sp. at San Juan, by Dr. H. L. Dozier, It resembles both *Prospaltella peltatus* Cockerell and *Encarsia portoricensis* Howard superficially, the "head and thorax mostly pale yellowish, the antennae and frons orange yellow," other parts of the wasp being mostly brownish black.

Encarsia basicincta Gahan (1927-20), of which the type was reared by Dr. H. L. Dozier from the woolly whitefly, *Aleurothrixus floccosus* (Maskell), is apparently quite a common parasite, for it has since been reared from its conspicuous but rarely abundant host. In general color this wasp is very pale yellow, almost white, marked with fuscuous; "antennae slightly dusky, legs entirely pale, all tarsi distinctly 5-jointed."

Encarsia portoricensis Howard (1907-77) was reared by Mr. Aug. Busck from whitefly material on a climbing vine at Bayamón, and wasps subsequently reared by Mr. R. H. Van Zwaluwenburg (P. R. 5022) at Mayagüez were identified as this species.

Encarsia nigricephala, reared by Dr. H. L. Dozier from whitefly material, *Bemisia* sp. on *Euphorbia hypericifolia* at Mayagüez, was described by him (1937-129) as being in general color pale yellowish "contrasting greatly with the black head, pronotum, and anterior discal two-thirds of praescutum."

Encarsia variegata (Howard), reared from whitefly material of *Paraleyrodes perseae* Quaintance on lemon foliage, occurs in Puerto Rico, having been identified by Dr. H. L. Dozier from his *Paraleyrodes naranjae* on citrus. It is characterized by an iridescent silvery white scutellum.

Encarsia vittata (Dozier) (1933–86) was described from material reared from a large whitefly, *Aleurodicus antillensis* Dozier, on "María" (*Calophyllum antillanum*) from Santurce, as an *Euderomphale.*

Eretmocerus portoricensis, the name given by Dr. H. L. Dozier to the local endemic species of wasp parasitizing most abundantly the woolly whitefly of citrus, *Aleurothrixus floccosus* (Maskell), formerly reported by him as *E. californicus* Howard, is characterized in his paper on "The Identity of certain Whitefly Parasites of the Genus *Eretmocerus* Hald., with Descriptions of New Species (Hymenoptera: Aphelininae)" (Proc. Ent. Soc. Washington, **34** (7): 112-118, fig. 1. Washington, D. C., October 1932) by the distinctive width and beaked shape of the antennal club.

Eretmocerus pallidus Dozier, as identified by Mr. A. B. Gahan, has been reared from the woody galls on the leaves of "corcho" (*Torrubia fragrans*) at Isabela.

Encyrtidae

The Encyrtid wasps have a large tibial spur on the middle pair of legs, which "enables them to execute great leaps, which they combine with flight" according to Dr. F. X. Williams (p. 254) in his "Handbook of the Insects and other Invertebrates of Hawaiian Sugar Cane Fields." Several Encyrtids from Hawaii which are parasitic on mealybugs have been introduced into Puerto Rico.

Pseudaphycus mundus is one of "Eight new Species of Chalcid-Flies of the Genus *Pseudaphycus* Clausen, with a Key to the Species" (Proc. U. S. National Museum, **96** (3200): 311-327. Washington, D. C., 1946) described by Mr. A. B. Gahan, which, under mistaken identity, was successfully introduced into Puerto Rico as a parasite of the mealybugs of sugar-cane. *Aphycus terryi* Fullaway, notes Dr. Williams, was "first found by Terry on Maui in 1909 and now (is) well distributed over the (Hawaiian) Islands." Mr. Gahan continues the story of how "living material of *A. terryi* was received in 1932 by T. E. Holloway, of the Bureau of Entomology and Plant Quarantine laboratory in New Orleans, from the Hawaiian Sugar Planters' Experiment Station in Hawaii. The original stock was apparently increased by propagation in the laboratory, "whence a shipment of parasitized grey mealybugs, *Trionymus boninsis* Kuwana, was sent to Puerto Rico on September 3, 1932." About a week after arrival, the parasites began to emerge and releases were made on the Station grounds. In making later examinations of mealybugs to determine if this introduction had been a success, a very similar parasite was reared from the pink mealybugs of sugar-cane. This proved to be, not the introduced parasite, but one hitherto unknown, determined by Mr. C. F. W. Muesebeck as *Pseudaphycus* sp. nov." (*in* Informe Anual Est. Exp. Insular P. R., 1932-3, pp. 92–103. San Juan, 1934), which Mr. Gahan eventually described under the name of *mundus*. He is of the opinion that "*Pseudaphycus mundus* may be indigenous in Louisiana, (for) it was reared at Audubon Park, New Orleans, as early as 1916, at least 16 years prior to the attempted introduction of *Aphycus terryi*. Circumstantial evidence would seem to indicate that in the attempt to increase the stock of the Hawaiian parasite in the laboratory, field collected material of the host which had already been attacked by *P. mundus* was introduced into the cage and the two species thus became confused."

Coccidoctonus trinidadensis Crawford, as recently determined by Mr. C. F. W. Muesebeck, was certainly the most abundant, and apparently the

only parasite of sugar-cane mealybugs in 1912, as is indicated by repeated rearings by Mr. Thos. H. Jones at that time. It has not since been found in Puerto Rico.

"**Pseudaphycus utilis** Timberlake, introduced by H. T. Osborn in 1912 from Vera Cruz, Mexico, (into Hawaii) completely changed the unsightly appearance of trees (infested with *Pseudococcus nipae* (Maskell), for almost immediately this mealybug was greatly reduced in numbers, so that now it is quite difficult to find a specimen of it. This wasp is yellowish to orange brown, compactly built, and including the wings, measures up to about 2 millimeters long" according to Dr. F. X. Williams (1931-255). In 1939, introductions into Puerto Rico of *Pseudaphycus utilis* were made by the Mayagüez Station, the wasp becoming established there and at Lajas, whence, according to the latest report by Dr. K. A. Bartlett (1943-19) it is "spreading rapidly."

The pineapple mealybug, *Pseudococcus brevipes* (Cockerell), apparently has no native parasites in Puerto Rico, and on the pan de azúcar and cabezona pineapples at Lajas is a very serious pest. Beginning in 1937, the Mayagüez Station began the importation of specific parasites of this mealybug: **Hambletonia pseudococcina** Compere, and **Anagyrus ananatis** Gahan (Proc. Hawaiian Ent. Soc., **13** (3): 357. Honolulu, March 1949), the type from Brasil, mistakenly recorded as Dr. Dozier's *A. coccidivorus* which he reared in Haiti from *Pseudococcus virgatus* (Cockerell). Importations were made from South America, and also via Hawaii, as is related by Dr. Kenneth A. Bartlett, telling of the "Introduction and Colonization of Two Parasites of the Pineapple Mealybug in Puerto Rico" (Jour. Agr. Univ. P. R. **23** (2): 67–72, ref. 2. Río Piedras, August 1939), and releases were made in all the principal pineapple producing regions of the Island. Subsequent search indicated that the introduced *Hambletonia* was well established and most effective in the control of the pineapple mealybug at Lajas.

Anagyrus similis is described by Dr. H. L. Dozier (1937-122) as very similar to his *A. coccidivorus*, but differs in having a "black head, pronotum, and prescutum." The type material was not reared, but swept from grass at Santa Isabel, Guánica and San Germán.

Anagyrus graminicolens was described by Dr. H. L. Dozier (1937-123) from an abundance of females swept from grass at Maní beach (Mayagüez) and from Guánica Lagoon. It may be "recognized by its long, prominently protruded, dark ovipositor, and very conspicuous black and white antennae," and "will undoubtedly prove to be a primary parasite of a grass-feeding mealybug."

Leptomastidea antillicola was described by Dr. H. L. Dozier (1937-121) from a single male reared by Dr. M. R. Smith from the mealybug *Pseu-*

dococcus virgatus (Cockerell) on the foliage of *Inga vera* at San Sebastián. It approximates 1.0 mm. in length, has green eyes and brown antennae, but the general color is yellowish, "the head and prescutum a soiled orange, the pronotum fuscous; the scutellum, mentanotum, propodeum and abdomen embrowned."

Leptomastix dactylopii was described by Dr. L. O. Howard from material reared from parasitized mealybugs in a greenhouse at Washington, D. C. He noted that one can "recognize infested scales by the fact that they lose almost entirely their wax or meal-like covering, and swell up into objects closely resembling dipterous puparia,... (a resemblance) which is heightened by the fact that the parasite in issuing cuts off a cap at the end of the scale insect, just as a dipterous insect forces off the end of its puparium." Dr. H. L. Dozier (1927-267) identified this wasp and redescribed it from material reared from *Pseudococcus citri* (Risso) at Río Piedras, as being "honey-yellow, with distinct reddish tinge on the mesonotum, the antennae and eyes blackish." It has previously been reared by Dr. Richard T. Cotton from mealybugs on cacao, and pupae from which this wasp emerged have been intercepted on guava fruits and on grapefruit at Palo Seco.

Achrysopophagus seini, "resembling a *Cheiloneurus* very closely" was described by Dr. H. L. Dozier (1927-269) from material which had been reared from mealybugs parasitized by *Leptomastix*, indicating that it "is most probably secondary, although absolute proof is lacking."

Achrysopophagus gahani was described by Dr. H. L. Dozier (1927-270) from a single female from parasitized mealybugs. Altho the material of this and *A. seini* actually reared was so scanty in amount, it may be presumed that if these wasps are in fact hyperparasites, they considerably reduce the effectiveness of *Leptomastix dactylopii* in the control of mealybugs.

Acerophagus nubilipennis, described by Dr. H. L. Dozier (1926-101) from two females, one from *Pseudococcus citri* (Risso), the other from *Pseudococcus adonidum* (L.), has not since been found. The general color of these wasps is "a very pale yellow, with the dorsum of a more pale orange tint, the abdomen pale with the hind margins of the two segments above the vibrissal plates brownish." The hyaline forewings have a conspicuous triangular smoky band across the disc.

Aphycus (Euaphycus) flavus Howard was the determination by Mr. P. H. Timberlake of the parasitic wasps reared by Dr. H. L. Dozier from *Pulvinaria iceryi* (Guérin-Méneville) at Arecibo. These wasps are orange-yellow above, but a paler yellow beneath, with pale yellow legs. This is the only record of *Aphycus flavus* from Puerto Rico, the wasps earlier reared from *Ceroplastes cirripediformis* Comstock by Mr. Thos. H. Jones having been identified by Mr. C. F. W. Muesebeck as a new species of **Aphycus,** "near *eruptor* Howard."

Plagiomerus cyanea (Ashmead), reared in Puerto Rico from *Ceroplastes cirripediformis* Comstock on lignum-vitae at Aguirre by Dr. H. L. Dozier, is redescribed and illustrated by him (1927-237), the genus being characterized by "the four-jointed funicle and the cluster of flattened scales at the apex of the scutellum".

Brethesiella sp. nov. is the determination by Mr. A. B. Gahan of one of the least abundant of the parasites of the wedding cake scale, *Icerya mont serratensis* Riley & Howard.

Cheiloneurus pulvinariae, described by Dr. H. L. Dozier (1925-263) as a supposed parasite of *Aphycus flavus*, is fully as large as its supposed host It has subsequently been reared from the cottony cushion scale, *Icerya purchasi* Maskell, and from the wedding cake scale, *Icerya montserratensis* Riley & Howard.

Dr. Kenneth A. Bartlett reports (Anon. 1939-100) rearing an undetermined species of **Cheiloneurus** from *Asterolecanium bambusae* (Boisduval).

Procheiloneurus sp. nov., as identified by Mr. A. B. Gahan, has been intercepted on a scale on citron at Ponce.

Coccidoxenus portoricensis was described by Mr. J. C. Crawford (1913-249) from wasps reared by Mr. Thos. H. Jones from *Ceroplastes cistudiformis* T. & C. It has since been reared from a scale intercepted on gandul.

Mercetiella reticulata, described by Dr. H. L. Dozier as one of "Some New Porto Rican Scale Parasites (Hymenoptera: Encyrtidae)" (Proc. Ent. Soc. Washington, **28** (5): 97–102, fig. 4. Washington, D. C. May 1926), is a robust wasp with black head and thorax, the abdomen testaceous yellow. It is possibly the most important parasite of the pustule scale, *Asterolecanium pustulans* (Cockerell), which is at times one of the most serious pests of numerous economic trees in Puerto Rico. The endemic "maga" (*Montezuma speciosissima*), which produces a wood even more desirable than mahogany for cabinet making, when attacked by this scale has many of its secondary branches killed. After infestations by the pustule scale have developed for some time, however, no more fresh injury appears on the host tree, and a careful investigation of the old scales indicates that practically all have been parasitized.

Euaphycus portoricensis Dozier (1926-100) is a less abundant parasite of the pustule scale: a yellow wasp of which the eyes have a greenish bloom in life. Dr. Dozier considers this and his *Mercetiella reticulata* as being unquestionably primary parasites, and the principal factors in the control of this scale insect.

Encyrtus infelix Embleton is reported by Dr. M. R. Smith as a common parasite of the hemispherical scale, *Saissetia hemispherica* (Targioni), in coffee groves, in his paper on "The Relationship of Ants and other Organisms to certain Scale Insects on Coffee in Puerto Rico" (Jour. Agr.

Univ. P. R., **26** (2): 21–27. Río Piedras, April 1942). "The parasite most commonly seen attacking the hemispherical scale was *Encyrtus infelix*, which was noted in coffee groves, in nurseries and in experimental plots. This species is about 2.0 mm. long, of a dark brown color, and of the general form of the workers of the acrobatic ants (*Crematogaster* spp.), closely resembling the latter superficially. It was noted that the female wasp, while apparently preparing to oviposit, would often stroke the scale with her antennae, thus causing the scale to void honeydew. The ants exerted little if any effect in reducing parasitization of the hemispherical scale by *Encyrtus infelix*. The wasps were on the plant hour after hour, and day after day, parasitizing the scales as they chose, unmolested by the ants." Abundant as Dr. Smith found this wasp, it had never previously been reared, nor has it since been obtained from the hemispherical or any similar scale. An adult, as determined by Mr. C. F. W. Muesebeck, has, however, been intercepted on banana leaf at Guayama.

Ageniaspis sp., as determined by Mr. C. F. W. Muesebeck, has been intercepted resting on lima bean foliage at Loíza.

Comperia merceti var. **falsicornis** Gomez, as determined by Mr. A. B. Gahan, was intercepted on Bryophyllum leaf.

From sections of the base of sugar-cane stalks infested with the scale insect, *Targionia sacchari* (Cockerell), collected at Río Piedras by Mr. Thos. H. Jones, wasps were reared which many years later were identified by Mr. C. F. W. Muesebeck as a species of **Coccidencyrtus.**

Arrhenophagus chionaspidis Aurivillius, as determined by Dr. L. O. Howard and Mr. A. A. Girault from separate rearings by Mr. Thos. H. Jones of what was at the time called *Hemichionaspis minor* Maskell, at Río Piedras and at Ensenada, has not been noted since in Puerto Rico.

Pseudohomalopoda prima Girault, as identified by Dr. H. L. Dozier, was obtained by him from lemon foliage infested with Diaspine scales at Mayagüez.

Homalopoda cristata Howard, as identified by Dr. H. L. Dozier (1937-123), was obtained by sweeping grass and weeds at Guayama and Mayagüez. This concludes the list of Encyrtid wasps which are parasites, either primary or secondary, on mealybugs or scale insects. Numerous other species of Encyrtids occur in Puerto Rico, each with a specific host quite different from the immobile scale insects or mealybugs.

Carabunia myersi, described by Dr. James Waterston as "A New Encyrtid (Hym., Chalcid.) bred from *Clastoptera* (Hom. Cercop.)" (Bull. Ent. Research, **19** (3): 249-251, fig. 1. London, December 1928), was from froghopper material collected at Soledad, Cienfuegos, Cuba by Dr. J. G. Myers. Later, Dr. Myers found that this wasp attacked various Cercopids in both Cuba and Haiti, but the first record in Puerto Rico

was obtained by Mr. Francisco Seín at Lares. Non-parasitized nymphs of the coffee froghopper he found so scarce that no adult was reared, even from the largest and most nearly adult nymphs. Within a few days after collection, all nymphs began to darken and shortly thereafter the black wasp emerged, thus paralleling in Puerto Rico Dr. Myers' experience in Cuba. The wasp is "black or blackish brown with only the faintest submetallic reflections (very dark green) on the thoracic notum, length about 2.0 mm." It is obviously responsible for the normal scarcity of froghoppers on coffee in Puerto Rico, but does not attack those of sugar-cane and other grasses, which are such serious pests in Trinidad and neotropical South America.

Aphidencyrtus aphidivorus Mayr, as determined by C. F. W. Muesebeck, was reared from aphids of sugar-cane by Mr. Thos. H. Jones, and later reported more specifically by Dr. F. M. Wadley (1937-107) as being parasitic on *Hysteroneura setariae* Thomas.

Oöencyrtus prenidis, described by Mr. A. B. Gahan, "A New Encyrtid parasitic in the Eggs of Hesperiidae" (Jour. Agr. Univ. P. R., **27** (3): 137-9, Río Piedras, July 1943), was reared from *Panoquina* (= *Prenes*) spp. skipper butterfly eggs on the leaves of sugar-cane. The wasps are "0.75 mm. long, the head as broad as thorax, the abdomen much broader than long, subtriangular, as broad as thorax but much shorter," mostly black in color, with distinct metallic luster, the "legs, including coxae, yellowish testaceous." In observing "The Seasonal Cycle of Insect Abundance in Puerto Rican Cane Fields" (Jour. Agr. Univ. P. R., **27** (2): 85-104, fig. 12, ref. 16. Río Piedras, June 1944), it was noted that "from October to February, when eggs are most numerous, two-thirds or more of all eggs collected are black with parasitism, and all of the smaller number of eggs during the summer are parasitized. Not a single caterpillar, from April to September," was seen, their scarcity being largely due to parasitism of the eggs by these Encyrtid wasps.

Oöencyrtus sp. nov., as determined by Mr. A. B. Gahan, considerably reduces the effectiveness of "A Dryinid Parasite attacking *Baldulus maidis* (DeLong & Wolcott) in Puerto Rico" (Jour. Agr. Univ. P. R., **22** (4): 497. Río Piedras, February 1939) according to Dr. Kenneth A. Bartlett.

Isodromus sp. nov., as determined by Dr. H. L. Dozier, was found issuing from *Chrysopa* pupae by Mr. Francisco Seín, the larvae of which had been feeding on mealybugs on avocado.

Homalotylus terminalis (Say), as determined by Mr. C. F. W. Muesebeck, was first reported under this specific name from Puerto Rico by Dr. M. D. Leonard as "A Braconid Parasite on a Coccinellid New to Puerto Rico" (Jour. Ec. Ent., **26** (1): 294. Geneva, February 1933),

but neither the parasite nor the ladybeetle was new to Puerto Rico. Eighteen years previously, Mr. Thos. H. Jones in his paper on "Aphides or Plant-Lice attacking Sugar-Cane in Porto Rico" (Bull. No. 11, Board Comm. Agr. P. R., pp. 19, pl. 2. San Juan, 1915) had noted that "unfortunately both *Megilla innotata* Vauls. and *Cycloneda sanguinea* L. are parasitized by a small wasp, *Homalotylus obscurus* Howard." *H. obscurus* Howard is a synonym for *H. terminalis* (Say). "Ladybeetle larvae which are parasitized by this wasp, after becoming fully grown, attach themselves to some firm surface as do healthy larvae before pupating. Then, instead of the larval skin splitting and disclosing the ladybeetle pupa, the skin remains entire, turns black and shrinks, so that outlines can be seen of several small bodies: the pupae of the parasitic wasp. Through holes made in the larval skin, opposite these pupae, the adult winged parasites later issue. However, it appears that this parasite is itself parasitized by a smaller related insect, as yet undetermined, which we have bred from parasitized ladybird larvae." Mr. Jones' material has recently been re-determined by Mr. Muesebeck as being *Homalotylus terminalis* (Say). This wasp is a common continental species, 1.0 mm. long, "body somewhat piceous; head yellowish, antennae blackish," to quote from Mr. H. L. Viereck (1916-500): "The Hymenoptera of Connecticut."

Syrphophagus mesograptae Ashmead, as recently determined by Mr. C. F. W. Muesebeck, has been repeatedly reared from Syrphid fly puparia by Mr. Thos. H. Jones, and more recently intercepted from Syrphid fly puparia on corn at Palo Seco.

Habrolepoidea celia, described by Mr. A. A. Girault (Descriptiones Stellarum Novarum, pp. 22, 1920, privately published pamphlet) from material reared from Syrphid fly puparia of a species of *Ocyptamus* by Dr. Richard T. Cotton, at Río Piedras, has since been found at Pt. Cangrejos.

Copidosoma truncatellum Dalman, as determined by Mr. C. F. W. Muesebeck, has been reared from the looper larva of *Pseudoplusia oo* (Cramer), and also from a looper caterpillar on sugar-cane, presumably *Mocis repanda* (F.), hundreds of small wasps emerging from the dead caterpillar, or the cocoon which it had been able to spin before killed by wasp maggots within its body. Despite the large number of wasps from a single caterpillar, the species is not abundant generally, judging by the few rearing records.

Copidosoma sp. nov., as determined by Mr. A. B. Gahan was reared by Mr. Francisco Seín from the larvae of the pepper flower-bud moth, *Gnorimoschema gudmanella* (Walsingham). According to Mr. Seín, it is "the common and abundant parasite of the pepper flower-bud moth in all regions in Puerto Rico at all seasons of the year." When most in-

tensively engaged in rearing these caterpillars, he had a large vial full of these live iridescent metallic green wasps, but in searching for a place in which to release them, found other individuals abundant in every pepper field examined.

Paralitomastix sp. nov., as determined by Mr. A. B. Gahan, was found by Dr. M. D. Leonard and Mr. A. S. Mills (1931-472) parasitizing over half of the larvae of *Brachyacma palpigera* (Walsingham) in dry pigeon pea pods and in dry crotalaria pods at every point where examinations were made from Río Piedras to Cabo Rojo.

Hunterellus hookeri Howard has possibly more unusual habits than any other Encyrtid wasp, for these black wasps may often be seen running about in the hairs of dog, just emerged from, or attempting to parasitize nymphal ticks. The common tick on dogs in Puerto Rico is *Rhipicephalus sanguineus* Latreille, and its nymphs are unquestionably the normal host, but Mr. Thos. H. Jones reared these wasps from *Dermacentor nitens* Neumann. First observed in Texas by Dr. W. D. Hunter and Dr. W. A. Hooker, and named after them by Dr. L. O. Howard, this unique wasp has since been found to have a much more extensive distribution, and its occurrence in Puerto Rico has subsequently been observed by Dr. H. L. Dozier and Mr. H. D. Tate. The former noted (1937-128) "in every case the parasites issued from the second stage (nymphal) females" and that usually seven to ten wasps had developed in a single nymphal tick. Mr. Tate found (1941-20) that over 90 percent of the tick nymphs on individual dogs were sometimes parasitized at Mayagüez. Indeed, the wasps are often so numerous on tick-infested dogs as to be apparent to anyone, crawling about between the hairs on the parts of the dog's body where tick-infestation is greatest. Parasitized nymphs, from which the wasps have emerged, will sometimes be noted where the dog sleeps, of full size, but papery and with a small hole thru which the wasps emerged.

Thysanidae

The Thysanid wasps are scale insect parasites which have only six joints in their antennae, as compared with the Aphelinids, which have from five to nine; the Encyrtids, which have eleven; and the Pteromalids and Eupelmids, which have thirteen. In his "Monograph of the Signiphoridae" (Proc. U. S. National Museum, **45:** 189-233. Washington, D. C., 1913), Mr. A. A. Girault describes the first wasps of this family recorded from Puerto Rico, **Thysanus fax,** the type from San Juan, reared from *Chrysomphalus personatus* (Comstock). From the same host infesting "laurel de la India" (*Ficus nitida*) in the plaza at Río Piedras, Mr. Thos. H. Jones reared additional wasps, but none has since been found.

Thysanus flavus (Girault) was reared by Dr. H. L. Dozier (1927-272)

from lignum-vitae material infested with *Aleurothrixus floccosus* (Maskell), at Aguirre.

Thysanus nigrus (Ashmead) was reared by Dr. H. L. Dozier (1927-271) from *Pseudococcus citri* (Risso) at Río Piedras. This is a common continental species, "recorded," according to Dr. E. O. Essig (1926-843), "on *Aspidiotus perniciosus* Comst. in New York and on *Coccus hesperidum* Linn. in California, length 5.5 mm., wholly shining black, middle and front of tibiae brown, tarsi white, basal half of wings infuscated."

Thysanus bifasciatus (Ashmead), as determined by Mr. A. B. Gahan, was reared from *Pseudococcus citri* (Risso) material at Río Piedras by Mr. Francisco Seín, "most probably hyperparasitic on either *Leptomastix dactylopii* or *Achrysopophagus seini*" according to Dr. H. L. Dozier (1927-272). This wasp was originally described from St. Vincent, B. W. I.

Torymidae

Torymus montserrati Crawford, as identified by Mr. A. B. Gahan, was reared by Prof. James G. Needham from galls in the seed pods of the primrose willow, *Jussiaea angustifolia*, caused by "the larva of an obscure little Cecidomyiid midge, *Asphondylia rochae* Tavares."

Colyostichus biannulatus Mayr, as determined by Mr. C. F. W. Muesebeck, has been reared from fruits of *Piper* intercepted at Cidra by Mr. R. G. Oakley.

Colyostichus logicaudatus Mayr, according to Mr. A. B. Gahan, who identified the material intercepted on "jagüey" or wild fig trees (*Ficus laevigata*) at Arecibo, is a parasitic wasp, and not a carpifier.

Idarnes carmae Walker females have extremely long ovipositors, and sometimes occur in large numbers resting on the underside of leaves of wild fig trees, "jagüey" (*Ficus laevigata*), being so numerous as to form an item in the food of the lizards *Anolis stratulus* which inhabit the trunks of such trees. These wasps have repeatedly been intercepted at Arecibo, as determined by Mr. A. B. Gahan, who considers them probably parasitic, and have also been collected in the mountains between Cayey and Salinas.

Prof. J. A. Ramos collected on Mona Island a small wasp which Mr. A. B. Gahan identified as a species of **Megastigmus**.

Eurytomidae

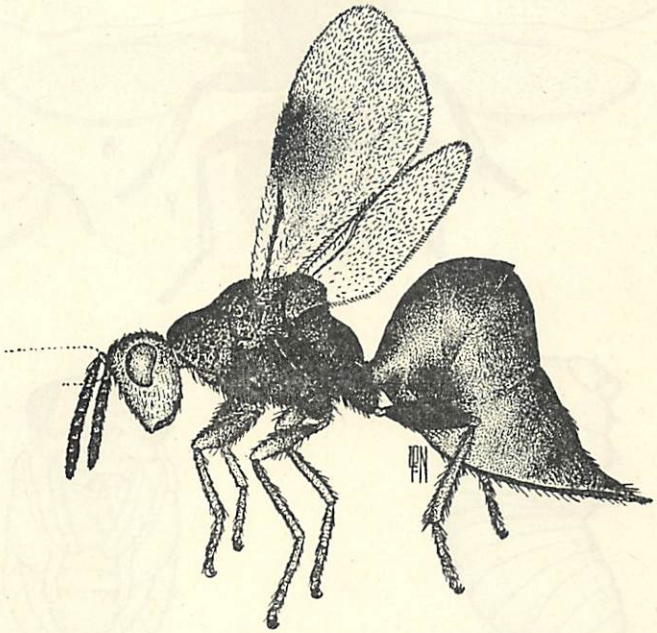
Eurytoma ctenodactylomyii was described by Mr. A. A. Girault (Ins. Insc. Menstruus **4:** 111. Washington, D. C., 1916) from galls in seagrape (*Coccoloba uvifera*) made by the Cecidomyiid midge, *Ctenodactylomyia watsoni* Felt, the type material having been collected in Puerto Rico.

Systole geniculata Foerster, as determined by Mr. A. B. Gahan, was

collected from the flowers of coriander at the Isabela Seed Farm in April 1948 by Dr. Luis F. Martorell.

Rileya megastigma Ashmead is the name given by Mr. A. B. Gahan to some relatively large reddish wasps reared by Prof. James G. Needham from galls in the seed pods of the primrose willow, *Jussiaea angustifolia*, caused by the larvae of the Cecidomyiid midge, *Asphondylia rochae* Tavares.

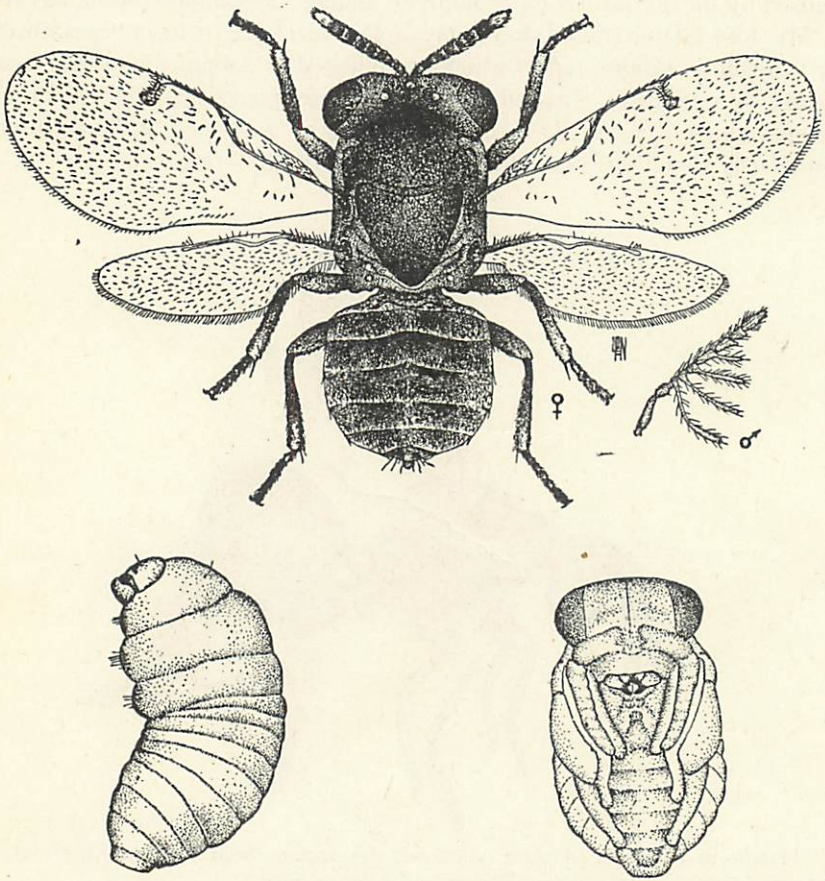
Mr. José I. Otero noted that many of the hard little fruits of "escambrón" or "tintillo" (*Randia mitis*) which he collected at Aibonito had their seeds eaten by maggots. Reared to adult, these proved to be Eurytomid wasps which Mr. A. B. Gahan identified as a species of **Prodecatoma** previously found on the Island of Tortola, British Virgin Islands.



Female of *Bephrata cubensis* Ashmead, the Annona Seed Eurytomid, about one hundred times natural size. (Drawn by L. Pierre-Noël.)

Bephrata cubensis Ashmead, because of the injury which is caused by the exit of adults from infested seeds of Annonaceous fruits, is possibly the most conspicuous of all the Eurytomids. In leaving the seeds where development has taken place, each wasp excavates thru the green fruit a separate straight tunnel to the outside, the edges of which dry and permanently harden. It is possible that this is not an endemic insect, for the first record in Puerto Rico was in 1925, made by Dr. H. L. Dozier on this one of "Two Important West Indian Seed-Infesting Chalcid Wasps"

(Jour. Dept. Agr. P. R., **16** (2): 103–112, fig. 5, ref. 2. San Juan, July 1932): on "guanábana" (*Annona muricata*) at Río Piedras. The wasp is by no means common, the only subsequent records being of interception by Mr. C. G. Anderson from "corazón" (*Annona reticulata*) at Villalba in 1931, and from the same host at Yauco in 1937.



The Campeche Seed Eupelmid, *Tanaostigma haematoxyli* Dozier: female above, about fifty times natural size; antenna of male; fully-grown larva and pupa below. (Drawn by L. Pierre-Noël.)

Eupelmidae

The wasps, formerly considered Encyrtids, but according to Mr. A. B. Gahan at present classified in the tribe Tanaostigmini of the family Eupelmidae, which Dr. H. L. Dozier found so abundant in the seed pods of logwood or "campeche" (*Haematoxylon campechianum*) in Haiti, and which

he described, with illustrations of larva, pupa and adult drawn by Mr. L. Pierre-Noël, as **Tanaostigma haematoxyli,** he subsequently found breeding in the same host at Mayagüez.

Tanaostigmodes portoricensis, described by Mr. J. C. Crawford (1913-247), the type from Puerto Rico, is listed by Mr. R. H. Van Zwaluwenburg (P. R. 1623) as having been reared from the seed pods of the "guamá" (*Inga laurina*).

Zaischnopsis sp. is the determination by Mr. A. B. Gahan of an iridescent blue-green wasp which has twice been found in the mountains: resting on "cedro" (*Cedrela mexicana*) at Cayey and intercepted in an orange grove at Consumo, in the mountains back of Mayagüez.

The egg-masses of *Callimantis antillarum* Saussure, which are at times so abundant, glued to the needles of the beefwood trees around Camp Kofresí on Mona Island, are parasitized by small black wasps which Mr. A. B. Gahan identified as a new species of **Anastatus.** On p. 129 of his "Descriptions of some New Species of Chalcidoides from Cuba and Puerto Rico" (Memorias de la Sociedad Poey, Cubana Hist. Nat., Universidad de Habana, **8** (3): 125–134. Habana, 1934), Mr. Gahan includes that of **Anastatus viridicaput,** reared from Mantid eggs in Puerto Rico, collected Jan. 4, 1923. The wasps from Mona very definitely did not have green heads. Other wasps of this genus in nearby islands attack the eggs of various moths and bugs, but the known local species have been reared only from Mantid eggs.

Eupelmus allynii French, as determined by Mr. A. B. Gahan, was repeatedly intercepted at Pt. Cangrejos by Mr. A. S. Mills from *Pluchea purpurascens* material.

Eupelmus coccidivorus Gahan, as determined by Mr. C. F. W. Muesebeck, was reared in 1913 by Mr. Thos H. Jones from the scale insect, *Saissetia nigra* (Nietner), on cotton at Ensenada. Parasitized material of this scale sent to California (Anon. 1941-43) many years later was found to harbor an abundance of these parasites.

Eupelmus saissetiae Silvestri is considered by Dr. H. L. Dozier (1927-272) as an important factor in the natural control of the black scale, *Saissetia oleae* (Bernard), in Puerto Rico.

Prof. J. A. Ramos (1947-63) records collecting two species of **Eupelmus,** as determined by Mr. A. B. Gahan, from Mona Island.

Lecanobius cockerellii Ashmead, the first scale insect parasite to be reported from Puerto Rico (Ashmead 1900-341), having been reared from scale insect material collected by Mr. Aug. Busck, was repeatedly noted by Dr. H. L. Dozier (1926-119 & 1927-272) as being possibly the most important factor in the natural control of the black scale, *Saissetia oleae*

(Bernard). It was also found attacking the material of *Saissetia nigra* (Nietner) sent to California (Anon. 1941-43) for release in citrus groves there, but we have no report on whether it was able to become established in California.

Miscogasteridae

The little wasps reared by Dr. Richard T. Cotton from pupae of the bean leaf-miner, *Agromyza inaequalis* Malloch, at first determined by Mr. C. F. W. Muesebeck as *Cyrtogaster liqueata* Ashmead, which was subsequently found by Mr. A. B. Gahan to be a synonym for **Halticoptera senea** (Walker), have been repeatedly reared from flowers of the wild "margarita" (*Bidens pilosa*) intercepted at Dorado and Guayama. *Agromyza caerulia* Malloch and *Agromyza pusilla* Meigen were both reared from these small daisy flowers and are presumably the hosts of this parasitic wasp, having been intercepted at the same time. In Prof. James G. Needham's popular presentation of his observations on "An Insect Community Lives in Flower Heads" (National Geographic Magazine, **40** (3): 340–356, illus. Washington, D. C., September 1946) of *Bidens pilosa*, or shepherd's needles, in Florida, the presence of one Agromyzid is noted, but not of its parasite.

Lelaps spp. nov., as identified by Mr. A. B. Gahan, have repeatedly been intercepted: in an orange grove at Mayagüez, in a citrus grove at Arecibo, on pomarrosa at Bayamón.

Eucharidae

The larval stage of the Eucharid wasps is passed as a parasite on ants. **Kalapa furcata** F., as determined by Mr. A. B. Gahan, was collected as an adult, on a guava bush at San Sebastián by Dr. Luis F. Martorell.

Orasema smithi Howard was collected by Dr. Donald De Leon at Patillas as an adult resting on a "María" leaf. These wasps are of most extraordinary appearance. Illustrations of the male and female of *Kalapa floridana* are given on p. 413 of Dr. Wm. Morton Wheeler's book on "Ants," and on p. 414, of the male and female of *Orasema virdis*.

Perilampidae

Reared in Puerto Rico, but presumably not released, were a few specimens of hyperparasite identified by Mr. A. B. Gahan as a species of *Perilampus*, probably males of *Perilampus paraguayensis* Girault, obtained from the puparia of parasites of the cotton stainers of Perú. The primary Dipterous parasites were *Acaulona peruviana* Townsend and *Hyaloma chilensis* Macquart, as was reported by Dr. Kenneth A. Bartlett under the

heading of "Biological Control Activities" (*in* Mayagüez Station Report for 1942, pp. 15–17. Washington, D. C., 1943).

Perilampus hyalinus Say, as determined by Mr. A. B. Gahan, has been intercepted resting on flowers at Bayamón.

Another wasp determined by Mr. A. B. Gahan as a species of **Perilampidea**, reared from the puparium of the Syrphid fly, *Baccha clavata* F., at Lares, is so strikingly vari-colored and brightly iridescent as to have been described ("IP" 1923-60) under the name of **larium** Wolcott.

Chalcididae

Hind femora, so greatly enlarged for jumping as laterally to appear almost hemispherical, characterize the wasps of the genus *Brachymeria*. Slow-moving and quiet when undisturbed, the wasps are able to take flight with such unexpected rapidity when alarmed that they simply disappear. To be sure, Dr. Alex. Wetmore records finding one having been eaten by a martin, but it is doubtful if they often fall a prey to birds, and they move much too fast to be caught by a toad, or even by the most alert lizard.

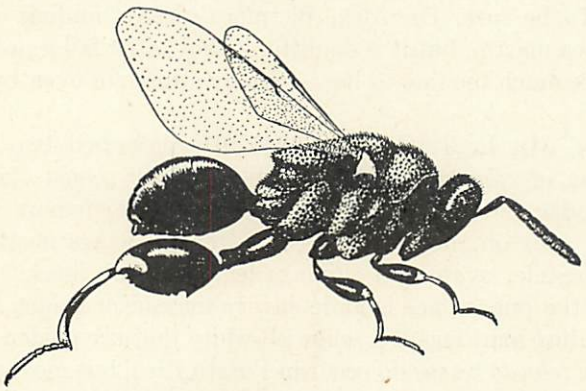
From Cuba, Mr. E. T. Cresson (1865-101) described two species, as *Chalcis*, noting of *robusta* that it was "black, very robust; face golden-sericeous; tegulae and legs, except coxae and posterior femora within and a large black spot on the outside, bright yellow; wings nearly hyaline; abdomen subsessile, ovate and shining; length $2\frac{3}{4}$–$3\frac{1}{2}$ lines," and of his *incerta* that "the pubescence is more silvery instead of golden," and that the corresponding markings are yellowish-white that are golden in *robusta*. Characteristic *robusta* wasps do occur in Puerto Rico, but most of the local golden wasps are so much more extensively black as to have been described as *robustella* Wolcott ("IP" 1923-56). Arranged according to abundance in Puerto Rico, **Brachymeria incerta** (Cresson) is clearly first, **Brachymeria robustella** (Wolcott) second, with single records only of **Brachymeria robusta** (Cresson) and **Brachymeria ovata** (Say).

The first economic record, by Mr. O. A. Barrett (1906-23), under the name *Chalcis annulata* F., is of wasps reared from the pupae of the cotton leaf caterpillar, *Alabama argillacea* (Hübner). This is possibly one of the most common hosts, from which these Chalcid wasps have repeatedly been reared. In very extensive outbreaks of cotton caterpillar at Camuy and Boquerón in 1923, all pupae collected were found to be parasitized, and indeed the one species **Brachymeria incerta** may be considered as almost entirely responsible for checking these outbreaks. During some years, however, *Alabama* does not occur at all in Puerto Rico, and to maintain itself, the wasp must attack other pupae, of which Mr. R. H. Van Zwaluwenburg noted that of the "plumilla," *Megalopyge krugii* (Dewitz); the

citrus Hesperiid, *Eantis thraso* (Hübner) now called *Achylodes papinianus* Poey; the canna Hesperiid, *Calpodes ethlius* (Cramer), and the cabbage butterfly, *Pieris* (now called *Ascia*) *monuste* (L.).

Altho these wasps are presumed to attack only caterpillars, if their selected host has previously been parasitized, the wasp maggots may develop within the dipterous maggots and eventually emerge from their puparia. Tachinid (Larvaevorid) fly *Carcelia flavirostris* (Van der Wulp) puparia have been found parasitized in this way at Cidra, over half of them from a mummied wooly-bear caterpillar of *Ecpantheria icasia* (Cramer) eventually producing wasps of *Brachymeria incerta*, one wasp from each puparium.

Extensive outbreaks of caterpillars seem especially susceptible to attack, the almost fully-grown caterpillars being parasitized, and the adult wasp emerging from the chrysalis or pupa. An outbreak of the comparatively



Brachymeria incerta (Cresson), ten times natural size. (Drawn by F. Maximilien.)

rare Hypenid, *Sudariophera fastigiata* (H.S.), at Boquerón in 1923 was checked by these wasps, as was that of the sugar-cane looper caterpillar, *Mocis repanda* (F.), at Aguadilla in 1931, and of cabbage Pierids, *Ascia monuste* (L.), from Guánica to Guayanilla in June 1937.

From these comparatively large pupae or chrysalids, only a single medium-sized wasp emerges, leaving considerable of their contents unused and not needed for the development of the parasite. Variation in the size of the wasps developing in different hosts is possibly to be expected, for much smaller Pyralids may also serve as hosts: *Psara bipunctalis* (F.) on amaranthus; *Eulepte concordalis* Hübner on "roble" (*Tabebuia pallida*); and undetermined leaf-webbing species on "jagüey," on "capá blanco" and on "mangle botón." Very much smaller adult wasps have been reared from the Cosmopterygid coconut leaf-caterpillar, *Homaledra sabalella*

(Chambers), but except in size, identical with the large wasps from larger hosts. *Brachymeria incerta* occurs not only in Cuba, Hispaniola and in all parts of Puerto Rico, but has also been collected on Mona Island.

The type of **Brachymeria robustella** (Wolcott) was reared from cocoons of the "plumilla," *Megalopyge krugii* (Dewitz), but the species was earlier indicated (Jones & Wolcott 1922-49) as parasitizing the pupae of the sugar-cane looper, *Mocis repanda* (F.), and Mr. E. G. Smyth had noted a female ovipositing in a pupa on July 25th at 1:42 P.M., from which the resulting wasp emerged on August 6th at 4:00 P.M.

Dr. Gundlach lists *Chalcis incerta*, as determined by Cresson, and notes *Chalcis robusta* Cresson "de los contornos de Mayagüez." What we recognize as the latter species was reared from a pupa of *Mocis repanda* (F.) at Boquerón in 1923.

Brachymeria ovata (Say), as identified by Mr. C. F. W. Muesebeck, was reared from a pupa intercepted at Mayagüez by Mr. A. G. Harley. Several other wasps of this genus, unidentified as to species, have been collected in Puerto Rico. One of the smallest of these was reared by Mr. Francisco Seín from one of the unidentified caterpillars which he found eating into the base of a pineapple fruit from Cidra.

Haltichella sp. is the determination by Mr. A. B. Gahan of a wasp reared by Mr. Francisco Seín from the common caterpillar, *Batrachedra mathesoni* Busck, which feeds at the base of pineapple fruit. The single wasp reared was from material collected at Corozal, in April 1940.

Dr. Gundlach lists as a *Smiera*, **Spilochalcis emarginata** (F.) as "rara," and Drs. Dewitz and Ashmead quote his record. It has not since been found in Puerto Rico.

Spilochalcis eubule, described by Mr. E. T. Cresson (1865-93) as *Smiera Eubule* Poey, MSS, and noted by him as destroying "the larva of *Callidryas Eubule*," is 4 lines long and luteous-yellow in color. The dull ferrugineous markings described by Mr. Cresson on the Cuban specimens are very dark brown on Puerto Rican individuals, and the vertex of the head is definitely black. Rearings have been made at Guánica and Río Piedras in Puerto Rico from the same host noted by Mr. Cresson, and also at Río Piedras from chrysalids of *Phoebis statira cubana* d'Almeida, of which the caterpillars feed on the tender leaves of "quenepa" (*Melicocca bijuga*). Adult wasps have been collected at Salinas, Guánica, Aibonito and Arecibo, as well as in Cuba and Hispaniola.

Spilochalcis flavopicta (Cresson), as identified by Mr. A. B. Gahan, was found among the dead or dying insects resting on the window-sills of the cotton ginnery at Isabela in September 1945, after its interior had been sprayed with 5 percent DDT dissolved in kerosene. Mr. E. Courtney Fife (1937-7) has recorded it as a parasite of *Pyroderces rileyi* (Walsingham),

dead adults of which moth were almost as abundant as PBW moths in the ginnery. Dr. Gundlach considered it "común" when he was collecting here, and Drs. Dewitz and Ashmead list it as a *Smiera*. Mr. E. T. Cresson (1865-99), describing it from Cuba as a *Smiera*, characterizes it as "black, varied with pale yellowish spots and marks; wings subhyaline; abdomen elongate, acuminate and pointed at tip; hind femora armed beneath with a row of numerous small teeth; length $1\frac{3}{4}$–3 lines." On Mona Island, Dr. Luis F. Martorell collected on weeds near Camp Kofresí a single specimen which Mr. A. B. Gahan identified as a species of *Spilochalcis* "very near to *flavopicta* Cresson, possibly only a variant."

Spilochalcis femorata (F.), according to Dr. B. D. Burks, in his "Revision of the Chalcid-Flies of the Tribe Chalcidini in America North of Mexico" (Proc. U. S. National Museum, **88** (3082): 237–354, fig. 9. Washington, D. C., 1940), "is perhaps the commonest species of this group in the West Indies and Central America, particularly in cultivated areas." In synonymy with it, Dr. Burks lists the records by Drs. Dewitz, Ashmead and Gundlach of the occurrence of *Smiera ignea* Cresson in Puerto Rico, as well as that of *Smiera punctata* F., concerning which Dr. Gundlach notes "las larvas de todas las especies de esta familia se crían dentro del cuerpo de orugas y larvas, o crysálidas y ninfas." Subsequently correctly listed by Mr. R. H. Van Zwaluwenburg (P. R. 49), it is presumably this species which Dr. Alex. Wetmore found to have been eaten by the ani. The lizards, *Anolis pulchellus* and *cristatellus*, are able to catch this wasp, altho not in large numbers. Repeatedly collected from various kinds of vegetation in all parts of the Island, it has been reared only once, by Mr. E. G. Smyth at Río Piedras, from *Psara bipunctalis* (F.), a Pyralid feeding on the leaves of the weed amaranthus. Mr. Charles E. Wilson, studying the "Truck-Crop Insect Pests in the Virgin Islands (Bulletin No. 4, Virgin Islands Agr. Expt. Station, pp. 35, fig. 24. Washington, D. C., 1923) records rearing this species, and also *Spilochalcis vittata* (Ashmead): a synonym for *igneoides* (Kirby), not known to date from Puerto Rico, from *Laphygma frugiperda* (Abbot & Smith), and from *Heliothis obsoleta* (F.). "This common tropical and subtropical species" to quote further from Dr. Burks, "yellow, orange or red with variable black markings, 5.5 to 8.0 mm. long, is most easily recognized by its very large compound eyes, the long and slender antennal flagellum with the three apical segments conspicuously shorter than the basal ones, the wide and deep scrobe cavity, and the usually large and acute basal tooth of the metafemur."

From coconut palm fronds infested with caterpillars of the Cosmopterygid moth, *Homaledra sabalella* (Chambers), not only were exceptionally minute adults of *Brachymeria incerta* (Cresson) reared, as already noted, but two other equally small wasps were also found. These were described ("IP"

1923-58) under the names of **Spilochalcis cocois** Wolcott for the one mostly yellowish-green in color, and **Spilochalcis homaledrae** Wolcott for the one mostly black. The former has subsequently been intercepted in a fruitfly trap at Bayamón; the latter was collected by Dr. Luis F. Martorell on the blossoms of "corcho" (*Pisonia albida*) on Mona Island, both determinations having been made by Mr. A. B. Gahan.

Spilochalcis hirtifemora (Ashmead) is the correct name, according to Dr. Burks (1940-295) for the small, yellowish-ferrugineous wasps reared from the puparia of Syrphid flies, *Toxomerus polygonastyla* Metcalf MS, collected on tobacco at Caguas and described ("IP" 1923-57) as *Spilochalcis syrphidis* Wolcott. This species occurs not only in Puerto Rico, but also in Hispaniola, Cuba and generally in the southern United States, having been reared not only from other Syrphid fly puparia, but also from *Apanteles* wasps.

Spilochalcis sp. nov. is the identification by Mr. A. B. Gahan of some minute wasps reared from the fish-scale-like cocoons, presumed to be of Dryinids parasitic on Fulgorid nymphs of *Ormenis* spp., found on both sides of grapefruit leaves at Manatí. In addition to these minute Chalcids, another parasite associated with this material may be a Lestrodyinini of the subfamily Anteoninae.

Ceratosmicra debilis (Say) has been identified by Mr. A. B. Gahan as the wasp reared by Mr. Thos. H. Jones from the pupa of *Oxyptilus* sp. on "sacatrapo" (*Caperonia palustris*), another specimen of which Prof. J. A. Ramos collected on Mona Island. It is a pale yellow wasp, with variable markings of tan, brown and black, the females 4.5 to 5.0 mm. long, the males averaging 1.0 mm. smaller.

Euchrysia buscki Ashmead, as identified by Mr. A. B. Gahan, was collected by Dr. Donald De Leon at Guánica resting on a mahogany tree.

Dirhinus giffardi Silvestri, a pupal parasite of the Mediterranean fruitfly, *Ceratitis capitata* (Wiedemann), originally from Nigeria in Africa but subsubsequently introduced into Hawaii, was received in Puerto Rico from Hawaii (Mayagüez Station Report for 1937, p. 95) and the wasps reared in the laboratory on housefly puparia. In succeeding years, liberations have been made at numerous points on the Island, but there is no record of recovery in the field from local fruitfly puparia.

Mr. A. B. Gahan has recently identified as a new species of *Trigonura* some large wasps collected at Indiera in the mountains between Lares, Maricao and Yauco on September 8th, 1921, which were apparently attempting to oviposit in the eggs or small larvae of the Cerambycid beetle, *Neoclytus araeniformis* Olivier, under the bark of logs of *Inga vera*. As compared with *Trigonura californica* Rohwer, which, according to Dr. E. O. Essig (1926-851), has been reared from the larvae of *Chrysobothris mali* Horn at Placerville, California, the local species, which I have named

Trigonuria puertoricensis n. sp., is larger, being 9.0 mm. long, and is entirely black except for chestnut femora, basal segments of fore and mid tarsi, and dark brown eyes. The propodeum is most coarsely and deeply shagreened, the remainder of the thorax unevenly and less shagreened, unevenly pubescent; the elongate, shining black or very dark red abdomen as long as the rest of the body; its basal and very pointed terminal segments each approximately one-third its total length, the intermediate four pubescent segments together not quite as long. The greatly dilated posterior femora is highly polished (as is also the sharply delimited region opposite the basal abdominal segment), darker at base, somewhat laterally and on the ventral margin, with one large and ten much smaller teeth. Eighteen females were collected originally, of which ten should be in the U. S. National Museum, and another was since found by Mr. Francisco Seín at Lares in December 1922, also on a log of *Inga vera*.

PROCTOTRUPOIDEA: Calliceratidae

Calliceras sp. and **Aphanogmus** sp. nov. were the determinations made by Mr. C. F. W. Muesebeck of the wasps which Mr. A. S. Mills obtained from *Pluchea purpurascens* material intercepted at Pt. Cangrejos.

Diapriidae

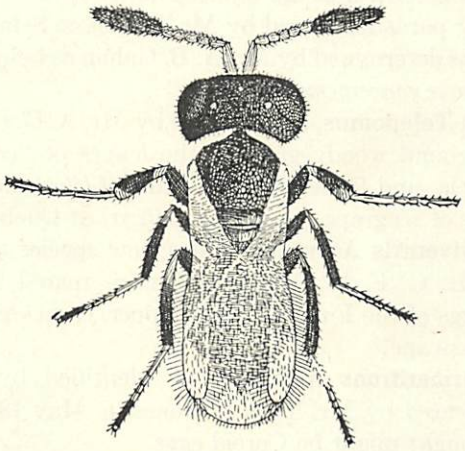
Ashmeadopria sp. nov., as determined by Mr. C. F. Muesebeck, is responsible for "a parasitism of ten percent of hornfly puparia" according to Dr. Kenneth A. Bartlett (1939-6). This wasp was subsequently reared from puparia of *Anastrepha mombinpraeoptans* Seín, the common jobo fruitfly.

Scelionidae

Phanurus flavus, described by Mr. Alan P. Dodd as "A New Proctotrypoid Egg-Parasite from the West Indies (Hym.)" (Entomological News, **25** (8): 350. Philadelphia, October 1914), was reared by Mr. Thos. H. Jones in April 1912, from the eggs of a Fulgorid, *Ormenis*, on the twigs of a shrub of *Cordia*. The females, 0.8 mm. long, are golden yellow, the eyes and ocelli black, and have 11-jointed antennae, while the males have 12 jointed, filiform antennae. This is a very common parasite on the eggs of the various species of *Ormenis*, and when an outbreak of these Fulgorids has developed, one will often find all egg-clusters parasitized.

Prophanurus alecto Crawford is a black Scelionid wasp which parasitizes the egg-clusters of the sugar-cane moth stalk-borer, *Diatraea saccharalis* (F.). The presence of a developing light yellow wasp of *Trichogramma minutum* Riley within the egg of the moth-borer causes the egg to turn black within less than 48 hours, and so also does the presence of the de-

veloping black wasp of *Prophanurus alecto*. Indeed, the latter is merely a nuisance to the entomologist attempting to make exact field observations on *Trichogramma*. In Puerto Rico at least, its incidence is so uncertain, its presence normally so rare, yet when noted at all, it occurs in such large numbers as to quite overshadow the more or less predictable variations in the abundance of *Trichogramma*, the much more common and economically important parasite. "*Prophanurus alecto* Crawford in Puerto Rico" (Jour. Ec. Ent., **32** (1): 152–3. Menasha, February 1939) was "first reared from the eggs of *Diatraea saccharalis* F. at Río Piedras and Toa Baja in 1921, and not found again on the Island until 1938. In October of that year it was the only parasite attacking egg-clusters of *Diatraea* at Isabela



Prophanurus alecto Crawford, eighty-five times natural size. (Drawn by G. N. Wolcott.)

(determination confirmed by Mr. C. F. W. Muesebeck) and mingled with *Trichogramma* at Quebradillas and Coloso. A month later it had disappeared from the Isabela region, but was responsible for seventy or eighty per cent parasitism of *Diatraea* eggs at Guánica (and thoroly disorganizing the *Trichogramma* release experiment there), where it had never before been collected. By the next month it was gone at Guánica, but had appeared at Patillas and Arroyo, where it had disappeared by the next observation. It was very abundant at Las Piedras in April 1939, and noted at Isabela, and again in December at Quebradillas, but has not since been recorded from anywhere in Puerto Rico."

Hoploteleia sp. nov., as identified by Mr. C. F. W. Muesebeck, was collected by Prof. J. A. Ramos (1947–64) on Mona Island, and has been intercepted on leaves of "almendro" at Bayamón.

Telenomus sphingis Ashmead is considered by Mr. A. B. Gahan (Proc.

U. S. National Museum, **77** (2831) Art. 8: 1–12. Washington, D. C., 1930) to be the correct name for the wasp parasitic on the eggs of the tobacco hornworm, *Phlegethontius sexta jamaicensis* Butler, noted by Mr. W. V. Tower in his reports as Entomologist at the Mayagüez Station in 1907 and 1909 as *Telenomus monilicornis* Ashmead, identification having been made by Mr. J. C. Crawford. Under the latter name, this wasp was described from the island of St. Vincent, but the type of *T. sphingis* Ashmead was reared from tobacco hornworm eggs at Jacksonville, Florida, and others have been reared from this host at Clarksville, Tenn., and from the Dominican Republic. It has not been reported from Cuba or Jamaica, and normally is not sufficiently abundant in Puerto Rico to be of much value in the natural control of the tobacco hornworm.

One of the rarer parasites reared by Mr. Francisco Seín from coffee leafminer material was determined by Mr. A. B. Gahan as being another species of **Telenomus**, "near *convergens* Ashmead."

Other species of **Telenomus,** as identified by Mr. A. G. Gahan, have been reared from the round woody galls on the leaves of "corcho" (*Torrubia fragrans*) at Isabela, and from the fleshy galls of *Ctenodactylomyia watsoni* Felt on the leaves of seagrape (*Coccoloba uvifera*) at Quebradillas.

Telenomus flaviventris Ashmead, and a new species of **Telenomus,** as determined by Mr. C. F. W. Muesebeck, were reared by Mr. Thos. H. Jones from the eggs of the Fulgorid planthopper, *Ormenis* sp., collected on the leaves of sugar-cane.

Hadronotus carinatifrons Ashmead, as identified by Mr. C. F. W. Muesebeck was reared by Mr. Thos H. Jones in May 1912 at Canóvanas from what he thought might be Coreid eggs.

Platygastridae

From galls on the leaves of trees of *Torrubia fragrans* (DumCours) Standley at Yabucoa, Dr. Luis F. Martorell reared numerous small black wasps, somewhat more than 1.0 mm. long, with brown legs and antennae, which Mr. C. F. W. Muesebeck identified as a species of **Isostasius.** As the other species of this genus are parasites of the larvae of gall-making Cecidomyiids, it is quite possible that wasps reared were hyperparasites on the insect actually responsible for the hypertrophy of the corcho leaves.

Leptacis sp. nov. was the determination by C. F. W. Muesebeck of a wasp intercepted at San Juan resting on a canna leaf.

Formicidae: ANTS: Cerapachyinae

Accompanying Dr. N. L. Britton, Director of the New York Botanical Garden, in March 1906 to Puerto Rico and Culebra, was that already eminent specialist in ants: Dr. Wm. Morton Wheeler. His paper on "The Ants

of Porto Rico and the Virgin Islands" (Bulletin American Museum of Natural History, **24** (6): 117–158, pl. 2. New York, February 7, 1908) remained the final authority for twenty-eight years. From July 1935 to June 1936, Dr. M. R. Smith was resident at Mayagüez, primarily observing ants in the coffee groves or in pineapple fields as they affected aphids, mealybugs and scale insects, but also collecting in the Maricao Forest and elsewhere. His observations were summarized in "The Ants of Puerto Rico" (Jour. Agr. Univ. P. R., **20** (4): 819–875, fig. 19, ref. 16. San Juan, October 1936). As it happened, however, neither of these specialists in ants found the rarest and most unique species occurring on the Island.

Cerapachys (Syscia) seini, described by Dr. Wm. Mann (Jour. Washington Acad. Sci., **21** (17): 440–1, fig. 1. Washington, D. C., October 19, 1931), was found by Mr. Francisco Seín, while conducting researches on "The Sugar Cane Root Caterpillar, *Perforadix sacchari*, new Genus and Species, and other new Root Pests in Puerto Rico" (Jour. Dept. Agr. P. R., **16** (3): 167–191, pl. 10. San Juan, August 1930): the sole representative in Puerto Rico of the subfamily Cerapachyinae. Dr. Mann thinks "it very probable that it is endemic to New Guinea and has been introduced into Puerto Rico in soil with sugar cane;" a suggestion which seems highly improbable considering that all the new varieties of sugar-cane brought to Puerto Rico were as cuttings from the Plant Quarantine greenhouse in Washington. Mr. Seín writes that "while digging in a moist clay loam, a nest of these ants was found in which an immobile and probably dead full-grown caterpillar of *Perforadix sacchari* was lying on its side, partly coiled, while several of the larvae of the ant were hanging from its sides with their mouth parts attached to its epidermis. Ant larvae are usually fed by the workers and this habit of directly feeding upon a caterpillar is extraordinary. We have been able to witness it on one occasion only. *Cerapachys* belongs to a group of primitive subterranean ants. The condition in which the ant larvae feed directly upon the dead or paralyzed caterpillars is apparently more primitive than the feeding of the larvae by the adult ants with regurgitated food." Dr. Smith did not find *Cerapachys seini* during his stay in Puerto Rico, and apparently the original record is the only one of its occurrence either here or elsewhere.

Ponerinae

Platythyrea punctata (F. Smith) is widely distributed in neotropical regions, the type being from the Dominican Republic. Dr. Wheeler found workers "running on the ground in a shady cafetal," and they have since been noted in a termite nest at Ciales. Dr. M. R. Smith states that the large black workers, so densely coated with pubescence as to appear pruinose or metallic, are predaceous, foraging singly on the ground or on the trunks

of trees. The nests are in shady coffee groves or forest, in stumps or logs, in colonies of only a few hundred individuals. Prof. J. A. Ramos noted (1947–64) a single worker on Mona Island. Collections from Puerto Rico are from the western end of the Island, none having been made on El Yunque or elsewhere in the Luquillo Mountains.

Euponera (Trachymesopus) stigma (F.), found by Dr. Wheeler "in Culebra nesting in a rotten cactus stump," and at Utuado in "small colonies under stones and logs," has been intercepted by Mr. R. G. Oakley on orange leaves in the mountains back of Ponce, and by Dr. Smith at Mayagüez and in the Maricao Forest at an elevation of 3,500 feet. The predaceous workers, slow of movement, are rarely seen foraging in the open, but the winged adults are very active.

Ponera ergatandria Forel, found by Dr. Wheeler only at Utuado "under prostrate plantain stems," is noted by Dr. Smith as "capable of living in both very arid and moist habitats," collections by Dr. H. L. Dozier at Guayama, Sabana Grande and Lajas having been made from under dry cow dung, and by Dr. Smith at Ensenada and Mayagüez.

Ponera opaciceps Mayr is possibly the commonest species of the genus in Puerto Rico, Dr. Wheeler having made repeated collections in the coffee groves around Utuado and in the mountains to the south, "under stones or under the bark of decaying logs in damp places." He also found it on Culebra, and Prof. J. A. Ramos (1947–64) recently made collections on Mona Island. Dr. Alex. Wetmore reports it as an item in the food of the swallow, and three individuals were noted in three square feet of pasture examined at Pt. Cangrejos. Dr. H. L. Dozier collected it under cow dung in the xerophytic regions of Puerto Rico, some of his collections being considered of the variety **jamaicensis** Aguayo by Dr. M. R. Smith, who notes distinguishing characters.

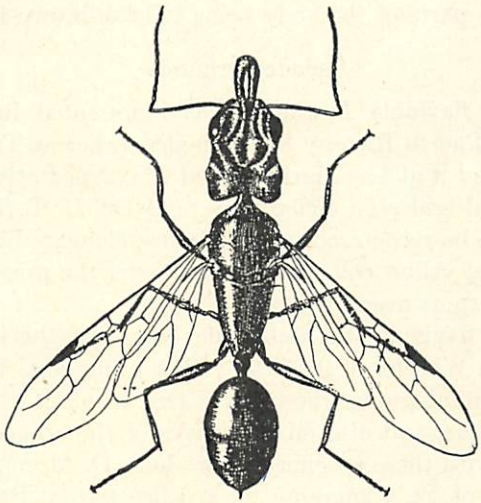
Ponera trigona var. **opacior** Forel is reported by Dr. M. R. Smith as having been collected in the mountains 14 Km. east of Mayagüez.

Anochetus mayri Emery was found by Dr. Wheeler wherever he looked, from El Morro at San Juan to Monte Morales and Monte Mandios, in small colonies of often only a dozen individuals "common under dead leaves and stones in shade of the cafetals and platanals." Dr. Smith also collected these ants from the coast at Arecibo and Mayagüez to the higher elevations in the Maricao Forest. He notes that "the workers, which are slow of movement, forage singly." They are eaten both by the grass lizard, *Anolis pulchellus*, and by the large, dark, crested lizard, *Anolis cristatellus*, in appreciable numbers.

Anochetus (Stenomyrmex) emarginatus testaceus Forel, noted by Dr. Wheeler only on Culebra Island, in the dry arroyos of Mount Resaca, occurs in colonies of thirty to one hundred individuals nesting under

stones in the shade of trees. It does occur in Puerto Rico, however, as Dr. Wm. Mann identified individuals intercepted in a grapefruit grove at Palo Seco.

"Berraco" is the common name in Puerto Rico for the fiercely biting, large black ant known as **Odontomachus haematoda** (L.) or its reddish brown and slightly smaller subspecies **insularis** Guérin-Méneville, variety **ruginodis** Wheeler, of which winged adults often come to light. According to Dr. Wheeler, "this variety, which is less common than the typical form of the species, was found only in open, sunny places in the sandy soil of river bottoms. It is smaller than the typical *haematoda*, has a paler head, and



The "Berraco," *Odontomachus haematoda* (L.), winged adult, five times natural size. (Drawn by F. Maximilien.)

the petiole is less acuminate above, with a shorter spine." Specimens identified by him as this variety were collected at Río Piedras by Mr. Thos. H. Jones under leaf-sheaths of sugar-cane, associated with mealybugs, and Mr. D. L. Van Dine found it in abundance around the roots of sugar-cane at Guánica. It has also been found on Vieques Island on the roots of sugar-cane. Prof. J. A. Ramos (1947–64) found a nest of the subspecies *insularis*, as identified by Dr. M. R. Smith, in a rotten stump of "papayo" (*Metopium toxiferum*) on Mona Island, and earlier collections by Dr. Luis F. Martorell on Mona have been identified as the typical form from a nest in a rotten stump, and adults at light at Sardinera Beach. These ants form an appreciable item in the food of three species of lizards, and Dr. Alex. Wetmore found them eaten by the petchary and the mocking-

bird. Living in part of a comején termite nest at Ciales, together with large Scarabaeid beetles, *Phileurus didymus* L., these aggressive ants occupied a considerable part of the nest in which live termites were their unwilling co-tennants. More usually, according to Dr. Smith, they live in well-rotted wood of logs and stumps, in nests of several hundred individuals, and he noted that "the workers can leap several inches by closing their widely opened mandibles suddenly, thus making a clicking sound."

As an "Addition to the Ant Fauna of the West Indies and Central America" (Bull. Amer. Museum Nat. Hist., **42** (8): 404. New York, 1920), Dr. Wm. Mann described from material collected by Dr. Wheeler at Monte Mandios, the variety **notata** of **Odontomachus haematoda,** as large as the typical form, but parts of the body being reddish-brown instead of black.

Pseudomyrminae

Pseudomyrma flavidula F. Smith was represented in Dr. Wheeler's collections from Puerto Rico by but a single worker at Tallaboa, but Dr. M. R. Smith found it at Las Marías and at Mayagüez attending the green and hemispherical scales on coffee trees, and Dr. H. L. Dozier at Lajas. "The worker can be recognized by its narrow, elongate body, exceedingly large eyes, general yellow color and on the gaster the presence of a pair of prominent black spots near the base."

Pseudomyrma flavidula var. **delicatula** Forel was the identification by Dr. Wm. Morton Wheeler of the little yellow biting ants which Mr. Thos. H. Jones found running over the badly rotted trunk of a tree near a cane field at Río Piedras, and also on the leaves of the adjacent cane plants. By comparison with these specimens, Mr. John D. More identified others found on cotton at Pt. Cangrejos, on a coffee tree at San Germán, and associated with *Platythyrea punctata* F. Smith in an old comején termite nest at Ciales. It has since been intercepted in grapefruit groves at Arecibo, Manatí and Bayamón, this variety apparently being reasonably common along the north coast.

Myrmicinae

Monomorium carbonarium (F. Smith), subsp. **ebeninum** Forel is one of the most common ants of the West Indies, and is possibly more abundant now than when Dr. Wheeler made his collections: on Culebra Island, and in Puerto Rico at Santurce, Vega Baja, Arecibo, Utuado, Adjuntas, Coamo Springs and Aibonito. He found this little black ant "common under stones, in Tillandsias and under bark," but otherwise gave it no exceptional notice. Entomologists working in cane fields first found it nesting under the leaf-sheaths, and in the tunnels of the moth-borer, and repeatedly noted it attending the yellow aphid of sugar-cane, *Sipha flava* Forbes,

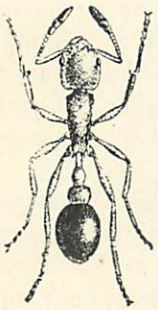
in various parts of the Island. Most recent intensive observations were to show "The Ant, *Monomorium carbonarium ebeninum* Forel, in a new Role, as Predator on the Egg-Clusters of *Diatraea saccharalis* F., in Puerto Rico Cane Fields" (Jour. Agr. Univ. P. R., **21** (4): 577–79. San Juan, October 1937), attacking about one-sixth of the nine thousand egg-clusters examined. No records are available of birds eating this little black ant, but it is eaten by the lizards *Anolis stratulus* and *Anolis cristatellus*. Mr. E. G. Smyth found it "injurious to the fruits of the roselle, *Hibiscus sabdariffa*, by nesting in them", and it has been found nesting in a cabbage head, tunneling among the inner leaves, as well as nesting under cow dung, at Río Piedras. Dr. M. R. Smith, collecting it at Lares, Las Marías and in the coffee groves back of Mayagüez, found it attending both the green and hemispherical scales, the workers being exceedingly fond of honeydew. In a poisoning experiment conducted against the hormiguilla in a tree of "guamá" (*Inga laurina*) at Mayagüez, large numbers of hormiga brava, coming up from the ground to fight the hormiguilla as to who should possess the thallium-poisoned meat, won a phyrric victory. Enormous numbers of dead of both kinds of ants eventually covered the ground beneath the tree bearing the poisoned bait. A few months later, the empty and deserted hormiguilla tunnels were found inhabited by *Monomorium carbonarium ebeninum*.

Monomorium destructor (Jerdon) "in its native country (India), is, like the rat, instrumental in disseminating the bubonic plague" according to Dr. Wheeler. He found only a single colony, at Tallaboa, at the base of an acacia tree, on the trunk of which the workers were moving in files up and down. Mr. R. H. Van Zwaluwenburg first collected it at Mayagüez, where Dr. M. R. Smith subsequently found a colony nesting in a bakery. Dr. H. L. Dozier collected it at Guayama, Ponce and Sábana Grande. It does occur on the north coast however, or at least the lizard *Anolis pulchellus*, found it there. "Workers may be recognized by their yellowish color, their shining bodies, and by the fact that they are highly polymorphic."

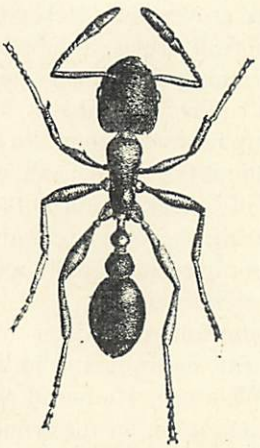
Monomorium floricola (Jerdon), noted by Dr. Wheeler as "common in Tillandsias, under bark scales of trees and in hollow twigs," is primarily a forest species, and is an item in the food of the woodpecker, according to Dr. Wetmore. Sometimes it inhabits the vacated cocoon of the "plumilla" (*Megalopyge krugii* Dewitz) quite the most snug and secure dwelling that any little ant could wish. It has been found in an empty moth-borer tunnel in a sugar-cane stalk, and also living in the pods of native lima beans. Dr. Luis F. Martorell found it nesting in a stump on Mona Island. We have most records of its nesting in the hollow twigs of coffee trees, at Lares, Peñuelas, Sabana Grande and San Germán. Dr. M. R. Smith noted it

obtaining honeydew from the green and hemispherical scales on coffee at Mayagüez, and carrying away dead insects.

Monomorium pharaonis (L.), a pale yellowish ant, most often found in urban areas, was noted by Dr. Wheeler nesting outdoors in the ground near the old government house of Culebra Island, and Prof. J. A. Ramos found it on Uvero Beach, Mona Island. Seven individuals were found in three square feet of pasture at Pt. Cangrejos, when that was still country and not a suburban development. All other records: at San Juan, Río Piedras, Arecibo and Mayagüez, are of occurrence in houses. It is, however, an item in the food of the little grass lizard, *Anolis pulchellus*.



Cardiocondyla emeryi Forel. (Drawn by R. B. Howe.)



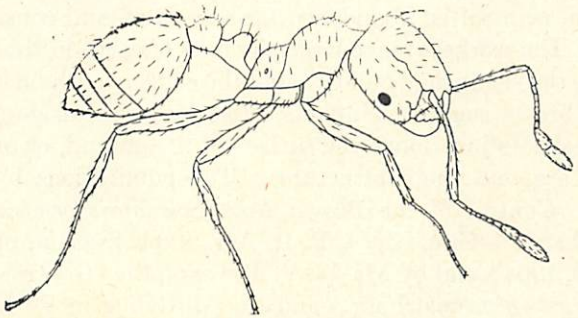
Cardiocondyla venustula Wheeler. (Drawn by R. B. Howe.)

Cardiocondyla emeryi Forel, a very small light reddish brown ant, originally described from St. Thomas, was found by Mr. August Busck on Vieques Island, by Dr. Wheeler on Culebra, and most recently by Prof. J. A. Ramos (1947–65) on Mona Island. It has been noted at many points in Puerto Rico, but "due to the extremely small size of the worker and its habit of commonly foraging alone, the species is often overlooked by the collector." The little grass lizard, *Anolis pulchellus*, did not find them too small to be overlooked as a source of food, and Dr. Wetmore notes this ant as being eaten by the woodpecker. Dr. H. L. Dozier found workers under dry cow dung at Sabana Grande and Lajas.

Cardiocondyla venustula, described by Dr. Wm. Morton Wheeler (1908–128) from small colonies on the beach of Culebra Island, and from winged females emerging from a nest in a gravelly creek bottom at Coamo Springs

on March 23d, 1906, was subsequently collected on Mona Island by Dr. Frank E. Lutz, according to Dr. M. R. Smith writing on the "Ants of the Genus *Cardiocondyla* Emery in the United States" (Proc. Ent. Soc. Washington, **46** (2): 30–41, pl. 1. Washington, D. C., February 1944) Dr. H. L. Dozier found workers in dry cow dung in very arid pasture areas at Ponce and Coamo. It is not common, altho eaten by the lizard, *Anolis pulchellus*, and by the swallow, according to Dr. Wetmore.

Solenopsis azteca Forel, of which the variety **pallida** was described by Dr. Wm. Morton Wheeler (1908–131) from a number of workers taken from a small nest in a dry stream bed at Coamo Springs, has "the body and appendages yellow, the head with a reddish brown cloud on the vertex." Dr. M. R. Smith found workers and winged queens on December 13th, 1935, just beneath the bark of stumps and logs in a coffee grove at Km. 14 of the road east from Mayagüez.



The "Hormiga Brava," *Solenopsis geminata* (Fabricius), worker, about twenty-five times natural size. (Drawn by F. Seín.)

Solenopsis corticalis Forel, originally described from St. Thomas, was found by Dr. Wheeler in a stem of bamboo at Utuado, by Dr. Smith in a coffee grove 16 Km. east of Mayagüez, and attending the pineapple mealybug in a pineapple field at Lajas.

Solenopsis geminata (Fabricius), the all too well known "hormiga brava", is characterized by Dr. Wheeler as being "so prolific, versatile and aggressive, and so fond of living in cultivated fields and in the neighborhood of human dwellings, that it has probably prevented many introduced species from extending their range, or even from gaining a foothold." "The meagerness of the native ant-fauna of Porto Rico and Culebra, may also, I believe," continues Dr. Wheeler, "be attributed in great measure to the aggressive habits of *S. geminata*. This ant prefers to nest in open sunny places and especially in sandy or loamy soil. It is much less frequent in shady woods or damp spots." "This ant not only stores up seeds in its

nests and is highly carnivorous, but it also attends aphids and coccids. In Culebra I found it visiting aphids on the leaves of the superb milk-weed, *Calotropis procera*, and in several localities in this island and in Porto Rico it was seen attending coccids on the roots of grasses and on the bark of trees." On Mona Island, it is abundant on the trees of beefwood (*Casuarina equisetifolia*) near Camp Kofresí, attending cottony cushion scale, and doubtless is in part responsible for the initial abundance of this scale when first found on Mona. Dr. M. R. Smith notes that "although this ant prefers to nest in open sunny places, its nests on some occasions are found in lightly shaded woods. The typical nest is a mound of loose earth with several entrances leading into it, but the ants may nest in the soil beneath cow dung. Their colonies are composed of thousands of individuals. Fertile, dealated queens are capable of starting colonies unaided." The mound of loose earth over the nest soon becomes packed down by tropical rains, so that it may remain unnoted for months, only to be renewed again, or as often abandoned for a fresh mound constructed a few feet away. The workers move large amounts of earth in this way, and by comparison, the sheds they build around the cottony-cushion scale on citrus or over the brown sugar-cane aphids, *Hysteroneura setariae* (Thomas), on young cane shoots just above the surface of the ground, or over pineapple mealybugs, are but minor structures. The publications by Mr. O. W. Barrett on "Control of the Brown Ant (*Solenopsis geminata* Fabr.) in Orange Orchards" (Circ. No. 4, P. R. Agr. Expt. Station, pp. 3. Mayagüez, May 9, 1904), and by Mr. W. V. Tower on the "Control of the Brown Ant (*Solenopsis geminata* Fabr.) and the Mealybug in Pineapple Plantations" (Circ. No. 7, P. R. Agr. Expt. Station, pp. 3. Mayagüez, 1908), indicate how important to the early citrus and pineapple growers was some means of control of this pest.

The abundance of the hormiga brava is to some extent indicated by the fact that Dr. Alex. Wetmore found that it had been eaten by the killdeer, ani, tody, mango, oriole, mozambique and grasshopper sparrow. It is more often eaten by lizards than is any other ant, having been noted in the stomachs of *Ameiva exsul*, *Anolis pulchellus*, *A. stratulus* and *A. cristatellus*. One hundred, twenty-two workers were found in three square feet of pasture at Pt. Cangrejos, altho no nest was present in the area examined. This sandy land near the beach was an optimum environment, typical of those where hormiga brava occurs in such numbers that to obtain sufficient food it not only eats all dead insects, and collects honeydew from aphids, mealybugs and soft scale insects, but, bypassing such intermediate agents, chews into the bark of young citrus trees where they have been grafted, and obtains the cell sap directly. Eggplants are attacked in the same way, and if not enough exudations occur on young corn leaves to satisfy the ants,

they stimulate their flow by biting into the tissue of the leaves. They carry away seeds, especially that of lettuce and tobacco, thus often necessitating the use of platform beds if any plants are to have a chance to grow.

The aggressiveness of hormiga brava in attacking other ants has already been noted by Dr. Wheeler. The occupation by *Monomorium carbonarium ebeninum* of hormiguilla tunnels of which their former tennants had been killed by hormiga brava was noted at Mayagüez, but in a hormiguilla-infested tree at Río Piedras on which thallium-poisoned meat baits had been placed, the hormiguilla decisively defeated the hormiga brava in the contest as to which should have possession of this toxic prize. These exceptional instances of inter-ant warfare merely happened to be observed; numerous comparable cases of contests with other ants are occurring all the time, but fail to be noted by the human observer.

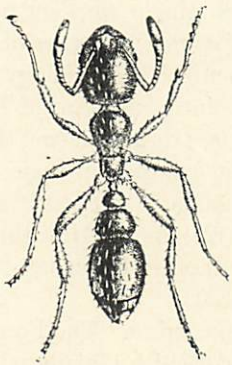
The reckless courage with which hormiga brava attacks other ants is matched by that with which single workers unhesitatingly bite human beings, as is attested by the well merited name of B R A V A. Mrs. Sophie D. Griffitts, of the Department of Bacteriology of the School of Tropical Medicine in San Juan, apparently unaware of Dr. Wheeler's note on the role of *Monomorium destructor* is disseminating the bubonic plague in India, implicates *Solenopsis geminata* as the only one of the "Ants as probable Agents in the Spread of Shigallia Infections" (Science, **96** (2490): 271–2. Lancaster, September 18, 1942), finding that they "may carry bacteria on their feet from one place to another for at least 24 hours after feeding on or traversing infected material."

Dr. Neal H. Weber has reported on "The Food of the Giant Toad, *Bufo marinus* (L.) in Trinidad and British Guiana with special reference to the Ants" (Annals Ent. Soc. America, **31** (4): 499–503, ref. 3. Columbus, December 1938). In Puerto Rico, the fully-grown adult toads eat ants only incidentally, the great bulk of their food being beetles and millipedes. The "zapitos" or very small adults, just transformed from the pollywog stage, are much too minute to swallow such large items of food, and Mr. Mario Pérez has found that their food consists largely of mites, springtails, nymphal leafhoppers and planthoppers, just hatched caterpillars, and ants. Any small ant will serve, but because hormiga brava is so common, it is more extensively eaten than any other. Admittedly, many zapitos would be required to eliminate even one colony of hormiga brava, but when abundant they may be a definite factor in biological control.

Solenopsis geminata affects man in so many ways, all of them to his disadvantage, that methods of control were sought by the earliest economic entomologists working in Puerto Rico. The crude carbolic acid emulsion recommended by Mr. W. V. Tower for use in the field is still one of the best and cheapest, altho DDT, chlordan and chlorinated cam-

phene give equally good results. Thallium sulfate baits are useless in the field, but in houses will serve to keep the ants out under ordinary conditions. Cyanogas flakes kill most of the workers in nests when applied directly, but do not kill the queen and workers deep in the ground, their effect being only superficial and essentially temporary. This is true, however, of all chemicals so some extent, for even if the original colony is destroyed, other ants come in to occupy the deserted tunnels, or to construct new ones in unoccupied territory. The competition for land is as keen among ants in Puerto Rico as it is among people, and destroying the ants present anywhere merely gives an opportunity for invasion by others shortly afterward.

Of the numerous chemicals recently developed which are effective in killing ants, none acts so promptly and in such minute amounts as technical



Solenopsis borinquenensis Wheeler. (Drawn by R. B. Howe.)

Hyman 118 or aldrin, quite incredible to one familiar only with the slowness and inadequacy of the crude carbolic acid emulsion. Within a few minutes after a pinch of the grannular powder is applied to the nest just broken open, the ants disappear without even attempting to bite, and they never reappear.

Ordinary people have little difficulty in recognizing *Solenopsis geminata* when it bites them, but of its morphological characters, Dr. M. R. Smith notes that "the worker is polymorphic, highly variable in color, ranging from reddish brown to black, glabrous, possesses a 2-segmented antennal club, and has no epinotal spines."

Solenopsis globularia (F. Smith) has workers considerably lighter in some parts of the body which were described and illustrated by Dr. Wm. Morton Wheeler (1908–131) as the variety **borinquenensis,** taken from "nests in the white sand of the sea-beaches just above high-water mark"

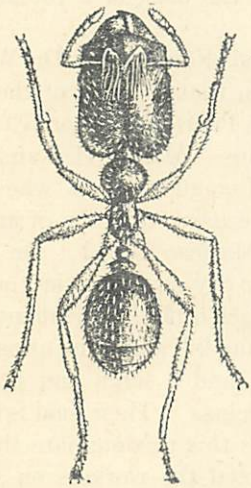
at El Morro in San Juan, and on Culebra Island. Workers of the variety **desecheoensis,** described by Dr. Wm. Mann on page 428 of "Additions to the Ant Fauna of the West Indies and Central America" (Bull. Amer. Mus. Nat. History, **42** (8): 403–439. New York, 1920), have a jet black body and yellowish brown appendages, and are apparently much more abundant generally, or at least in the western end of the Island. Dr. H. L. Dozier collected them repeatedly under dry cow dung at Lajas, Ensenada, Guánica Lagoon and at Coamo, and Dr. M. R. Smith found them on the sandy beach at Mayagüez.

Solenopsis picea Emery has workers which are very dark and glabrous. This species was found only once in Puerto Rico: by Dr. Wm. Morton Wheeler "from a single colony nesting under the bark of a rotting log" at Utuado.

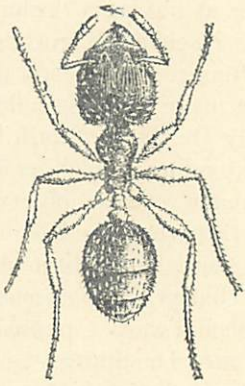
Pheidole fallax jelskii Mayr, variety **antillensis** Forel, which Dr. Wheeler describes as having a "color more vivid" than that of some of the other varieties, he collected on Culebra Island, and in Puerto Rico from El Morro at San Juan to Utuado and the higher mountains. Mr. R. H. Van Zwaluwenburg made the first collection from the Mayagüez region, where subsequently Dr. M. R. Smith found it one of the most common of ants, its range extending as high as 3,000 feet in the Maricao Forest. Dr. H. L. Dozier made repeated observations on it under dry cow dung in the more xerophytic parts of the Island. Its workers attack other insects many times their own size, having been observed to attack and kill a live and apparently normal changa, *Scapteriscus vicinus* Scudder, and a large and powerful female Scoliid wasp, *Campsomeris dorsata* Fabricius. "Their food is largely flesh" states Dr. Smith, "and so strongly does this predominate that the ants have a distinctly fecal odor. I have noted the workers on several occasions attending the green and hemispherical scales (on coffee), and the aphid, *Pentalonia nigronervosa* Cockerell, on bananas, thus indicating that the diet of this ant is not entirely flesh. The nest is easily recognized by the peculiar elongate, slit-shaped entrance holes." Of a colony at Río Piedras, Mr. E. G. Smyth noted that the entrance was "usually more than an inch across in one direction and less than quarter of an inch in the other; the earth is carried so far from the burrow that there is no semblance of an ant-hill. A number of the ants were found dragging a live cutworm (*Feltia annexa*) towards their burrow, the large-headed soldiers giving invaluable assistance in this work, and they have been observed more than once bodily dragging the still living larvae of *Pieris monuste* and *Melanchroia cephise* from their food plants and carrying them to their nests." Dr. Wetmore found that this ant had been eaten by the mockingbird, thrush and mozambique, and Mr. A. H. Madden found it in the stomach of the Surinam toad, *Bufo marinus*. It is eaten by four species of lizards: *Anolis pulchellus*,

A. krugii, *A. stratulus* and *A. cristatellus*. It has been found that this ant "harbors the intermediate or cystic stage of the tapeworms of the *Raillientina* group in the chicken," according to the 1938 Report of the Experiment Station at Mayagüez.

Pheidole flavens Roger subspecies **exigua** Mayr, redescribed by Dr. Wheeler (1908–134) from three females and numerous soldiers and workers from colonies under stones and logs in the open woods and cafetals of Utuado and the higher mountains to the south, was found by Dr. Smith only in coffee groves between Maricao and Mayagüez. Mr. J. D. More identified specimens collected at Cayey on *Inga vera* as being this species.



Pheidole subarmata borinquenensis Wheeler: soldier. (Drawn by R. B. Howe.)



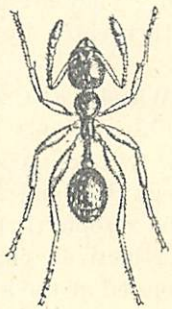
Pheidole moerens Wheeler: soldier. (Drawn by R. B. Howe.)

Of the subspecies **sculptior** Forel, Dr. Wheeler found only a single soldier at Coamo Springs, but Dr. Smith observed colonies in rotten stumps in coffee groves, and on the sandy soil of the beach at Mayagüez, beneath a coconut husk.

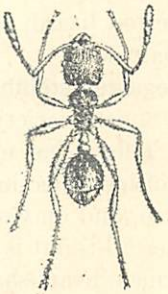
Pheidole moerens was described by Dr. Wheeler (1918–136) from numerous specimens taken under stones and prostrate plantain trunks in the woods and cafetals of the Utuado region and the higher mountains to the south. It also occurs on Culebra Island, and Prof. J. A. Ramos found it on Mona Island, "under stones at the base of the cliffs." Despite these records, it would appear to be primarily a mountainous species, found most

often in coffee groves and in virgin forest as high as 3,000 feet, Dr. Smith having collected it in the Maricao Forest.

Pheidole megacephala (F.), a cosmopolitan, imported species, lives mostly in urban environments, and has been noted at Río Piedras in successful combat with *Solenopsis geminata*, for a time at least extending its colonies and hunting range where hormiga brava had previously been firmly established. Dr. Wheeler notes that "the most careful search failed to reveal the presence of *Ph. megacephala* in Culebra, but in the little island of Culebrita, less than a mile to the eastward, it is in full possession to the exclusion of every other ant. Here I found it everywhere: in the masonry walls of the lighthouse on the highest point on the island, under stones and logs throughout the thickets and in crater nests on the beaches of the foraminiferous sand down to the high water mark. It is probable that it had



Pheidole subarmata borinquenensis Wheeler: worker. (Drawn by R. B. Howe.)



Pheidole moerens Wheeler: worker. (Drawn by R. B. Howe.)

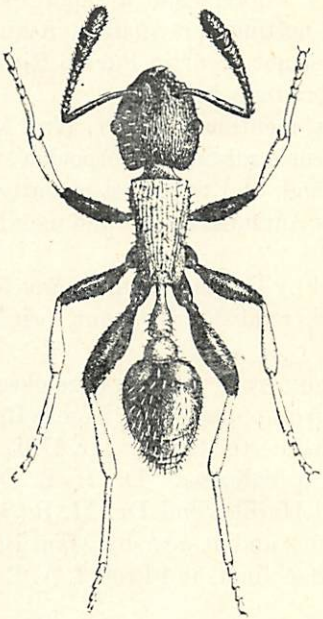
been prevented by *Solenopsis* from gaining a foothold in Culebra, for I can hardly believe that winged females of *Pheidole* have been unable to cross the narrow channel which separates the two islands. In Porto Rico, *Ph. megacephala* is so sporadic in its occurrence as to suggest either that it has been introduced at several widely separated points and has been unable to spread, or that it has been exterminated over a large portion of its range by the fire-ant." Dr. Wheeler identified specimens collected at Río Piedras by Mr. Thos. H. Jones, who found them attending mealybugs on sugar-cane in 1912, and the large and vigorous colony noted in the yard of a house opposite the Plaza del Mercado in 1921 was apparently extending its range at that time, but no recent collection has been made at Río Piedras. Dr. Smith's observations are based on a single colony in his back yard at Mayagüez, and interceptions have been made in ginger roots at

San Juan; attending aphids on lima beans at Loíza, and at Arecibo with no data as to environment. Certainly Dr. Wheeler's prediction as to the losing fight it was waging against hormiga brava was correct, if one may judge by the scarcity of recent records of its presence in Puerto Rico.

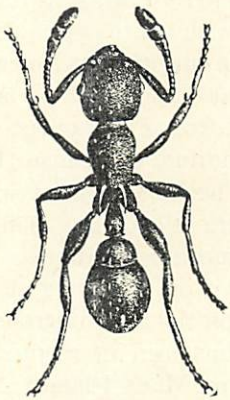
Pheidole subarmata Mayr, of which Dr. Wheeler (1908–133) described the "dark chestnut brown" variety **boriquenensis** from Puerto Rico, illustrating soldier and worker, occurs with "only a few soldiers and workers in a colony, in sandy, sunny places like roads and creek bottoms." It is a rather common species, which Dr. M. R. Smith (1936–844) found nesting in both clay and sandy soils, attending the green and hemispherical scales, and the aphid *Pentalonia nigronervosa* Cockerell on plantains. Dr. H. L. Dozier found soldiers and workers common in cow dung. Mr. A. H. Madden noted them feeding on the eggs and nymphs of the changa, *Scapteriscus vicinus* Scudder, and eaten by the Surinam toad. They are also caught by the crested lizard, and Dr. Wetmore found then eaten by the grasshopper sparrow.

Crematogaster steinheili Forel, listed by Dr. Wheeler as *Crematogaster victima* F. Smith, variety *steinheili* Forel, is stated by him to be "common; nesting in Tillandsias, under bark or in the hollow twigs of various trees," but none of his collections: at Coamo Springs, Vega Baja and Aibonito in Puerto Rico, and on Culebra Island, was from the xerophytic part of the Island where this ant is really abundant. It is distinctively characterized by a brownish, heart-shaped abdomen, sharply pointed at the apex, which it elevates almost vertically when running about, with the remainder of the ant light yellowish in color. Most of our records are of occurrence on the south coast: repeatedly under the bark of lignum-vitae or "guayacán" (*Guaiacum officinale*), the ants arranged about the margin of the bark-scale with their heads out; under loose bark of mahogany (*Swietenia mahagoni*) at Guayama; nesting in stump at Ponce; attending mealybugs on wild croton at Yauco; attending *Crypticerya rosae* Riley and Howard on lignum-vitae at Guánica and attending the soft scale, *Coccus hesperidum* L., on papaya leaves (*Carica papaya*) at Guánica. This particular soft scale seems to be preferred by these ants, for they have also been noted attending it on papaya leaves at Luquillo and at Río Piedras. In all cases when attending soft scales or mealybugs carton nests had been built by the ants, comparable to those reported by Dr. Wheeler on Culebra over unspecified species of coccids on both surfaces of the large shining leaves of the "moral" tree, *Cordia sulcata* (= *C. macrophylla*). Dr. Smith "found the ants in some of the driest areas of the Island, at Ensenada, Guánica and Lajas, as well as some of the most moist: at San Germán and Mayagüez, hence am led to conclude that it is a highly adaptable species." He found it attending the aphid *Aphis gossypii* Glover, and the mealybugs

Pseudococcus nipae (Maskell) and *P. brevipes* (Cockerell). In the more humid parts of the Island, it has been observed attending the aphid *Toxoptera aurantii* Fonscolombe on water-shoots of "mamey" (*Mammea americana*) at Isabela Grove, Pt. Salinas; nesting in dead coffee twigs between Guayama and Jájome Alto; abundant on "jagüey" (*Ficus laevigata*) at Maunabo; abundant on cotton at Villalba; and nesting in empty cocoon of the "plumilla," *Megalopyge krugii* (Dewitz), in citrus tree at Fajardo.



Macromischa isabellae Wheeler. (Drawn by R. B. Howe.)



Macromischa albispina Wheeler. (Drawn by R. B. Howe.)

Macromischa isabellae, described by Dr. Wm. M. Wheeler (1908–138) from type material collected at an elevation of 3,000 feet, at the summits of Monte Morales and Monte Mandios, from colonies under the roots of an epiphytic orchid and in a hollow twig, he took "great pleasure in dedicating this, the most beautiful of Porto Rican ants, to Mrs. Elizabeth G. Britton." Subsequent collections have been made at Indiera, between Yauco and Maricao, on coffee and coffee shade trees, and nesting in an old stump. Its workers have hairs which are "snow-white, sparse and erect; mandibles, antennae, head, coxae, femora and gaster blue black; the first gastric segment with a brilliant satiny reflection, visible only in certain lights; thorax,

petiole, post-petiole and trochanters dull orange red; tips of mandibles, tibiae, tarsi and two elliptical spots at the base of the first gastric segment, honey yellow." Dr. M. R. Smith found typical specimens at Las Mesas, near Mayagüez, at an elevation of only 800 feet. From workers in the Maricao Forest, characterized by the "absence of epinotal spines," he described (1936–847) the subspecies **mutica.**

Macromischa albispina, described by Dr. Wheeler (1908–139) from Culebra Island, is almost entirely blue-black in color with white epinotal spines. The type material was of "thirty workers and a single female, (which) represented a single colony found nesting in a small cavity in the ground in the shade of a thicket." It does not occur in Puerto Rico and no interested person has since visited Culebra to look for it.

Macromischa albispina pallipes Wheeler, mentioned by Dr. Wm. Mann (1920–424) as a variety of *albispina*, but since raised to subspecific status by Dr. Wheeler, occurs only on Mona Island, and was most recently collected there by Prof. J. A. Ramos. Its legs, antennal scapes and mandibles are yellowish white.

Rogeria curvipubens Emery, as identified by Dr. M. R. Smith, was found by him at Ensenada. It is a small, dark reddish-brown ant, originally described from St. Thomas.

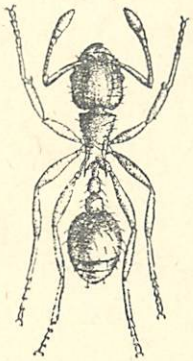
Tetramorium guineense (F.), of which numerous workers were observed by Dr. Wheeler eating the ripe and broken fruit of papaya on Monte Resaca on Culebra Island, was soon after found in Puerto Rico by Mr. D. L. Van Dine in moth-borer tunnels in sugar-cane at Yabucoa. Dr. H. L. Dozier collected it on cow dung at Humacao and Hatillo, and Dr. M. R. Smith found it on the Station grounds at Mayagüez and at near-by Maní Beach. Twice it has been intercepted in houses in San Juan, and Prof. J. A. Ramos found in on Mona Island.

Tetramorium lucayanum Wheeler, as identified by Dr. M. R. Smith, was found by him in an old stump in a coffee grove near Mayagüez and on the floor of a barn on the Station grounds. It is a shining black ant, originally described from the Bahamas.

Tetramorium simillimum (F. Smith), a very small yellow ant, was found by Dr. Wheeler on Culebra "nesting under stones and logs on the beach," and in Puerto Rico only at Coamo Springs in the creek bottom. It has since been intercepted at San Juan, and the lizard, *Anolis pulchellus*, has collected it for food at Río Piedras. It is possibly more abundant in the western end of the Island, for Dr. M. R. Smith reports numerous collections by himself, and by Dr. H. L. Dozier under cow dung.

Wasmannia auropunctata (Roger), the "albayalde," has a sting which is more painful and decidedly more lasting, for most people, than that of any other tropical ant. Dr. Wheeler, recording the occurrence of this ant

on Culebra Island, and in Puerto Rico from El Morro at San Juan to the tops of the mountains, and especially in the coffee groves at Utuado and Adjuntas, makes no mention of this, its most obvious characteristic. Because this little yellow ant is so small, and because it is so slow to anger, it gets under the clothes of coffee pickers unnoted, and bites the tenderest and least exposed parts of the human anatomy. Not only do the peones refuse to pick coffee where these ants are known to be abundant, but they will not even attempt to enter such areas, which, in effect, are abandoned to the "albayalde." Mr. R. H. Van Zwaluwenburg reports the albayalde as killing out and displacing colonies of hormiguilla in coffee. Its workers are slow and deliberate in their movements, and, like soldiers going up to the front, proceed at widely spaced intervals along the coffee stems. This is not from fear, or danger of attack, for no coffee picker will knowingly

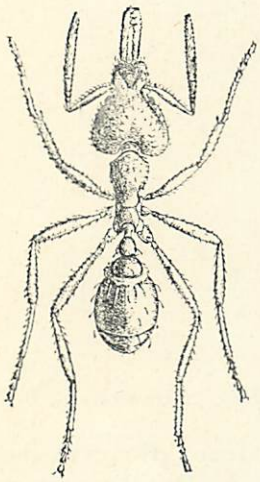


The "Albayalde," *Wasmannia auropunctata* (Roger). (Drawn by R. B. Howe.)

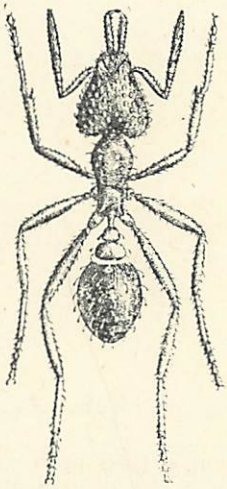
disturb them, if their presence is observed in time. However, the typical coffee grove-inhabiting birds readily eat them, Dr. Wetmore reporting them in the stomachs of the swift, the swallow, the oven-bird and the parula warbler. All six species of lizards of the genus *Anolis* eat them in considerable abundance. Altho the albayalde is thought of as being characteristically of coffee groves, actually it is present in all the more humid parts of Puerto Rico, and five individuals were found in three square feet of sandy pasture near the beach at Pt. Cangrejos. Dr. Luis F. Martorell found them on the ground near Camp Kofresí on Mona Island. The early entomologists specializing on sugar-cane found the albayalde repeatedly attending mealybugs on sugar-cane, and the yellow aphid, *Sipha flava* Forbes. Mr. J. D. More found this ant entering small holes in the buds of sugar-cane. In the coffee groves, the albayalde, formerly attending only mealybugs and the aphid, *Toxoptera aurantii* Fonscolombe, greatly favored the rapid multiplication and spread of the green scale, *Coccus viridis*

(Greene), when that pest first appeared in Puerto Rico. The cottony cushion scale, *Icerya purchasi* Maskell, was promptly adopted by the albayalde for its especial care on citrus trees, when it was accidentally introduced. Indeed, from the standpoint of man, the albayalde has nothing to recommend it, but until recently no method of control gave promise of any value, and it is yet to be demonstrated on a field scale that DDT or chlordan or aldrin will be as effective as small scale tests indicate.

Strumigenys eggersi Emery, originally described from St. Thomas, was not found in Puerto Rico by Dr. Wheeler, but Dr. M. R. Smith reports "a dealated queen beneath a rock in the Maricao Insular Forest at an altitude of 3,000 feet" and the discovery by Mr J. W. Balock of a colony of about thirty individuals under cow dung in a pasture at Juana Díaz.



Strumigenys rogeri Emery. (Drawn by R. B. Howe.)



Strumigenys obscuriventris Wheeler. (Drawn by R. B. Howe.)

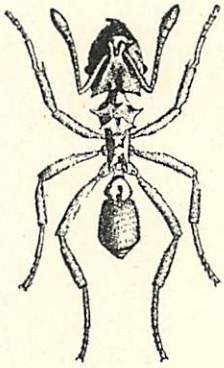
Strumigenys rogeri Emery, originally described from St. Thomas, Dr. Wheeler discovered in colonies nesting under stones in the dry stream bed at Coamo Springs. It is possibly the most abundant of the genus in Puerto Rico: a little yellow ant with large head and prominent mandibles. Dr. Alex. Wetmore found it eaten by the mozambique, and presumably it was this species which was found eaten by the crested lizard. Dr. M. R. Smith notes colonies at Arecibo and Mayagüez, in stream beds and in coffee groves.

Strumigenys louisianae Roger, of which Dr. Wheeler described (1908–145) the Puerto Rican variety under the name of **obscuriventris,** with

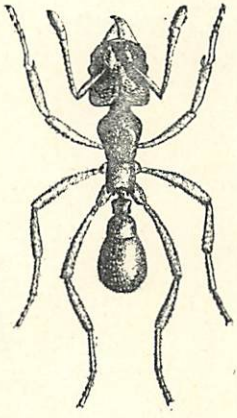
"the gaster, except at the base, dark brown or black, and the ferruginous tint of the body in general darker," is a continental species from the Gulf Coast states, with very elongate mandibles. Dr. Wheeler found a few isolated individuals at Utuado under prostrate plantain trunks and several colonies in the dry stream bed at Coamo Springs. Dr. M. R. Smith noted colonies nesting in soil beneath stones at Mayagüez and at Ensenada.

Of **Trichoscapa membranifera** subspecies **simillima** (Emery), as determined by Dr. M. R. Smith, a single worker was collected under dry cow dung at Lajas by Dr. H. L. Dozier.

Quadristruma emmae (Emery), originally described from St. Thomas, was found by Dr. M. R. Smith in small numbers in Puerto Rico: two workers at Ensenada and a single individual at Arecibo.



Mycocepurus smithi (Forel). (Drawn by R. B. Howe.)



Mycetophylax brittoni Wheeler. (Drawn by R. B. Howe.)

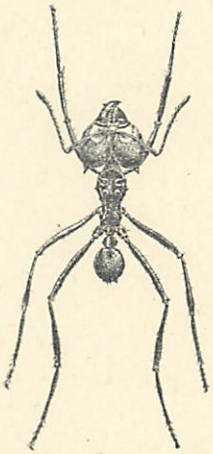
Mycetophylax brittoni, described as *Myrmicocrypta* by Dr. Wheeler as one of "The Fungus-Growing Ants of North America" (Bull. Amer. Mus. Nat. History, **23** (31): 669–807, fig. 31, pl. 5. New York, September 30, 1907) from numerous opaque, black workers with yellowish mandibles collected by him in Santurce, has not since been found.

Cyphomyrmex rimosus (Spinola), subspecies **minutus** Mayr, collected by Dr. Wheeler on Culebra, and in Puerto Rico from Arecibo on the coast to the crest of the highest mountains, is comparatively common in all parts of the Island. It was first noted under cow dung at Río Piedras by Mr. Thos. H. Jones, and subsequently by Dr. H. L. Dozier at Hatillo and San Germán, but its small colonies occur more often under rotted stumps and logs. Dr. Smith notes that "the workers of this ant, because of its small

size and resemblance in color to the soil, is not always easy to see, and furthermore the ants have the habit of feigning death. Their food consists of yellowish, pear-shaped bodies of fungus."

Mycocepurus smithi (Forel), of which Dr. Wheeler (1907–718) described the variety **borinquenensis** from specimens collected at Vega Baja, Arecibo, Utuado and Monte Mandios, was observed in the western end of the Island by Dr. Smith. As the lizards *Anolis pulchellus* and *Anolis stratulus* were found to have eaten this ant in appreciable numbers, it is possibly much more abundant than the few collections by entomologists would indicate.

Trachymyrmex jamaicensis (André) was found by Dr. Wheeler on Culebra Island, and Prof. J. A. Ramos (1947–66) collected it on Mona Island. Both it and the preceding species were formerly considered to be



Atta sexdens (Linnaeus), the Fungus-Growing or "Parasol" Ant of South America, twice natural size. (After Wolcott.)

of the genus *Atta*, but their former sub-generic names have now been raised to generic status. In Trinidad and Cuba, destructive species of fungus-growing or "parasol" ants do enormous damage in defoliating citrus, cacao, mango and other economic trees, but no comparable species of *Atta* exists in Puerto Rico.

Dolichoderinae

Tapinoma melanocephalum (F.), most intimately and unfavorably known to the householders of Puerto Rico as a stinking little ant called "albaricoque," not only has a black head, as is indicated by the scientific name, but also a black thorax. The gaster is whitish. Other ants invade houses now and then, and can be repelled with the thallium baits, but

the ubiquitous albaricoque is irrepressible. It is continually drowning itself by the dozen in water bottles, with an island of its corpses forming on the water film, ever increasing in size if undisturbed, for the ants never seem to learn how to avoid being drowned. Most fortunately, the aerosol pyrethrum and DDT sprays not only kill the ants immediately, but usually are effective in preventing the return of their comrades for some time at least. Dr. Wheeler mentions their "nesting under stones and under the bark of trees" on Culebra, and at Ponce, Tallaboa, Utuado and Arecibo in Puerto Rico. At the present time the ant is common in all urban areas, much less often occurring out in the country, and hardly at all in virgin forests. In the three square feet of pasture area examined at Pt. Cangrejos, seventy-four individuals were found. Prof. J. A. Ramos found the albaricoque nesting in a rotten stump of *Coccoloba laurifolia* on Mona Island. Dr. Smith notes their attending the pineapple mealybug and the green scale on coffee, but they are more often seen carrying away dead insects, or attacking helpless, inactive stages, such as pupae. Albaricoque has been noted eaten by the lizards *Anolis evermanni*, *A. pulchellus* and *A. cristatellus*.

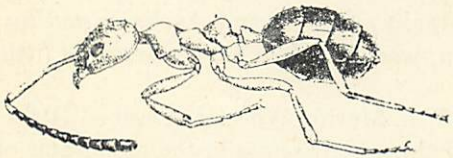
Tapinoma littorale Wheeler, originally described from the beaches of the Bahamas and southern Florida, is a singularly inappropriate name for this ant in Puerto Rico, which Dr. Wheeler found only at Monte Morales and Monte Mandios at an altitude of 3,000 feet, nesting in hollow twigs and bushes. This is indeed its true habitat, for Dr. H. L. Dozier made collections at Doña Juana, and Dr. M. R. Smith in the Maricao Forest, at Maricao, and between Maricao and Mayagüez. It has been intercepted at Aguas Buenas, but the lizards *Anolis pulchellus* and *Anolis cristatellus*, mostly from the Río Piedras region, were found to have eaten this little pale yellow ant.

Iridomyrmex melleus, which Dr. Wm. Morton Wheeler described (1908–151) as one of the most common of the arboreal ants in the mountains of Puerto Rico, "is distinguished by its slender, graceful appearance and the general honey-yellow colored body" according to Dr. Smith. The carton nests, which Dr. Wheeler figures and describes, are built of "earth mixed with vegetable debris on the underside of the huge reniform leaves of the 'ortegón' (*Coccoloba rugosa*) in the angles formed by the thick veins with the leaf-membrane." "As they contained brood as well as the ants, they can not be regarded as aphis sheds." Such nests have been repeatedly noted on coffee trees, in the dead hollow twigs of which the ants also nest, or in the bark at the crotch, or between crossing limbs.

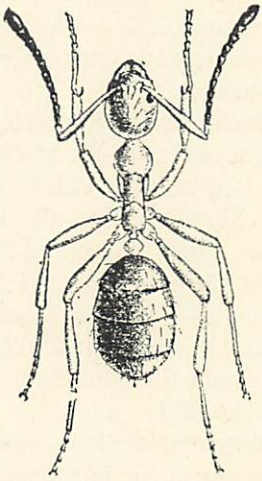
Don Francisco Frontera Monrroig, of Bo. Indiera Baja of Maricao, claims that this apparently inoffensive ant actually does drive out the hormiguilla (*Myrmelachista ramulorum*) from its tunnels and occupy the

tunnels itself. If this does occur, it does not happen often enough to be of much importance in the control of hormiguilla.

At Río Piedras and at Aibonito, colonies have been found in the empty cocoons of the "plumilla," *Megalopyge krugii* (Dewitz), and Dr. Luis F. Martorell has observed colonies in dry twigs of "galán del monte" (*Cestrum laurifolium*) at Aibonito. Dr. M. R. Smith found the workers attending mealybugs on Tillandsias, the green and hemispherical scales and the aphid, *Toxoptera aurantii* Fonscolombe, on coffee. These ants have been found in the stomachs of the lizards *Anolis pulchellus* and *Anolis stratulus*. A variety of this ant described by Dr. Wheeler (1908–153) as **fuscescens** has "the body and appendages fuscous, the gaster black, the mandibles yellow and the tarsi whitish." The type material was from Monte Morales and Monte Mandios. Dr. Smith found this variety in the Maricao Forest in the axils of the leaf-sheaths of the sierra palm, *Euterpe globosa*.



Iridomyrmex melleus Wheeler. (Drawn by R. B. Howe.)



Iridomyrmex melleus Wheeler. (Drawn by R. B. Howe.)

Dorymyrmex pyramicus (Roger) variety **niger** Pergande, a medium-sized black ant having "a sharp and pointed conical elevation on the epinotum" is common, according to Dr. Wheeler, "in sandy and sunny places in nearly all the localities visited in Porto Rico, but could not be found on Culebra." On Mona Island, Dr. Luis F. Martorell found it nesting in a stump and attending the cottony cushion scales on the beef-wood (*Casuarina equisetifolia*) trees near Camp Kofresí. Since its collection by Dr. Wheeler at Vega Baja no other record occurs of its existence in the eastern end of Puerto Rico, not even the lizards being able to find it,

nor did Dr. Smith note it at Mayagüez, his records being from San Germán southward. In January 1923, workers were found in abundance on cotton growing at Boquerón.

Formicinae

Brachymyrmex heeri Forel, originally described from St. Thomas, was found by Dr. Wheeler at Santurce and Utuado in Puerto Rico, as well as on Culebra. Mr. R. H. Van Zwaluwenburg first noted it at Mayagüez, and Dr. Smith also found it there and in several near-by localities and up into the Maricao Forest, attending mealybugs on pineapples and on coffee shade trees, as well as all the aphids and fleshy scales occurring on coffee. It is not at all common in the eastern end of the Island, but the lizards *Anolis pulchellus* and *Anolis cristatellus* from the Río Piedras region found some to eat.

Brachymyrmex heeri var. **obscurior** Forel, "a darker form, with very similar but apparently more epigaeic habits," according to Dr. Wheeler, is locally much more abundant. Mr. Thos. H. Jones found it attending the yellow aphid of sugar-cane, *Sipha flava* Forbes, at Río Piedras, and Dr. Smith gives a long list of aphids, scale insects and mealybugs from which it has been observed to obtain honeydew. "I have actually seen workers of this species with apparently uninjured and healthy pineapple mealybugs in their mouths" he states.

Paratrechina longicornis (Latreille), formerly in the genus *Prenolepis* (*Nylanderia*), the "hormiga loca" or crazy ant, a shining, intensely black species with long antennae and legs, is an imported ant found mostly in urban areas. Dr. Wheeler noted it "very common in houses, gardens and fields" in Culebra, and everywhere in Puerto Rico except in the highest mountains. "The slender, long-legged *Prenolepis longicornis* shoots about like an arrow over the rocks and pavements, so that one seems to see only whirling black lines crossing one another on the ground." He must have been thinking of an arrow which constantly changes its direction of flight, to accurately describe the progress of these ants, which arrive by speedy indirection. When thallium acetate was being mixed with meat for hormiguilla poisoning experiments, the file of crazy ants across the laboratory pavement quickly discovered the meat, and gorged themselves so that their gasters were like distended globular balloons, lined with black chitinized stripes. They died by thousands, but were promptly replaced by other thousands, whenever additional fresh meat bait was being prepared, the colony seeming to suffer no appreciable loss in population despite the obvious and known mortalities. Mr. H. K. Plank, conducting "DDT Investigations" (Mayagüez Station Report for 1946, p. 32) found them effectively controlled by 5% DDT in kerosene, but their place promptly occu-

pied by other species of ants. One of the earliest records (1910) of this ant was at Caguas, where it was a most annoying pest in digging up and removing tobacco seeds from the seed-beds. More often, however, it lives on sandy beaches, especially under the older fronds of coconut palms. Only four individuals were noted in the three square feet of sandy pasture examined at Pt. Cangrejos, but on the beach at Mameyes they are enormously abundant, attending mealybugs and *Orthezia insignis* Browne on "cariaquillo" (*Lantana camara*). On the beach at Mona Island around Camp Kofresí, they had become established while the camps were inhabited, but it remains to be seen how long they will survive now that the Island has been so nearly deserted by man. In reality, they do not invariably and directly depend on his presence for food, as Dr. Smith states that "they are known to attend the cotton aphid (*Aphis gossypii*), the green scale (*Coccus viridis*) and the pineapple mealybug (*Pseudococcus brevipes*)," and in a cane field they have been observed attacking a caterpillar of *Perichares phocion* (F.), that was attempting to pupate. Dr. Wetmore reports no bird eating them, but they are eaten by the lizards *Anolis pulchellus*, *A. stratulus* and *A. cristatellus*.

Paratrechina (Nylanderia) fulva (Mayr) was first noted in Puerto Rico by Mr. D. L. Van Dine, attending mealybugs on sugar-cane at Humacao. It is definitely not common, as the only subsequent collections were by Mr. L. Courtney Fife, who found it attending aphids on cotton, and by Dr. M. R. Smith, attending mealybugs on pineapples at Arecibo.

Dr. M. R. Smith (1936–868) described "four workers collected from the soil beneath a stone in a rather dense wood at Km. 14 east of Mayagüez" as **Prenolepis (Nylanderia) microps,** a strictly subterranean species of pale color and with extremely small eyes.

Paratrechina (Nylanderia) steinheili (Forel) is another rare species, of which Dr. Wheeler found but two workers, at Santurce and at Adjuntas. Dr. Smith found small colonies of these reddish-brown ants in the Maricao Forest, as well as at Mayagüez and Lajas.

Paratrechina (Nylanderia) vividula (Nylander) was found by Dr. Wheeler on Culebra and in the mountains of Puerto Rico, and small yellow workers from a nest in the stem of a banana at Maricao were determined as this species by Dr. Wm. Mann. By comparison, Mr. J. D. More identified others on coffee and on coffee shade trees at Utuado.

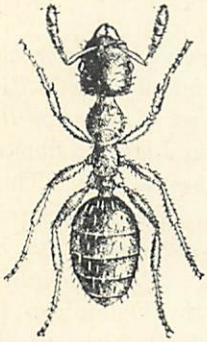
Camponotus ustus Forel is a large yellow ant which Dr. Wheeler found nesting in the ground under a block of beach-worn coral on Culebra Island, and in Puerto Rico in the hollow twigs of seagrape (*Coccoloba uvifera*) at El Morro in San Juan, and of other trees at Utuado and Monte Mandios. Dr. Smith found it at Ensenada in the dead branch of a tree; at Mayagüez in stumps, posts and dead branches of trees, and in the Maricao Forest.

It has also been collected in an old stump at Utuado; in dead twigs of *Inga vera* at Utuado and at Ciales; in an old stump at San Sebastián; in coffee at Lares; in "cenizo" tree (*Tetrazygia elaeagnoides*) at Vega Baja; in hollow twigs of "abeyuelo" (*Colubrina ferruginosa*) and "aceitillo" (*Zanthoxylum flavum*) at Guajataca; and at both Isabela, Quebradillas and Ciales under the loose bark of "tortugo amarillo" (*Sideroxylon foetidissimum*). From a large stump used as a fencepost along the Manatí-Ciales road, with a big comején nest on top, when sprayed with 5% DDT in kerosene, these ants came running out of the numerous entrances of their previously unsuspected nest so rapidly that they fell to the ground. Apparently their foraging workers go out only at night, for in a wooden house at Río Piedras, many were noted each night running about, altho all kept safely hidden in the daytime. The very pale winged females collected at the base of a rotten stump on El Yunque in June 1935 were identified by Dr. Smith only as to genus.

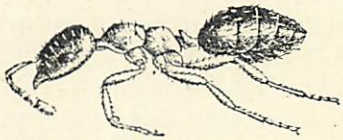
Camponotus sexguttatus (F.) is more slender and darker in color, and apparently occurs but rarely in the western end of Puerto Rico. Dr. Wheeler found it on Culebra Island in hollow twigs of seagrape (*Coccoloba uvifera*), and of the material from El Morro, San Juan, he illustrates the carton diaphragm over the opening in the seagrape twig. The earliest collection in Puerto Rico was made by Mr. Aug. Busck at Fajardo. The dark colored workers with reddish heads were noted by Mr. Francisco Seín at Naguabo in rotten posts of "bayahonda" (*Prosopis juliflora*) imported less than three years previously from the Dominican Republic. Mr. H. K. Plank found "a colony nesting inside the dried fruits of the Frescora trees" at Loíza Aldea, and Mr. J. Sepúlveda found a colony nesting in the rotten roots of a mango tree at Mayagüez. The workers which Dr. Wheeler noted at Coamo Springs were on flowers of "bejuco de corrales" (*Serjania polyphylla*).

Myrmelachista ramulorum, described by Dr. Wm. Morton Wheeler (1908–155) as a new subspecies of *ambigua* Forel from St. Vincent, is the "hormiguilla": the only ant of economic importance of all the endemic ants of Puerto Rico. A larger and more robust subspecies: *fortior*, the type from Mona Island, others from Puerto Rico, was subsequently described by him on p. 189 of "Neotropical Ants collected by Dr. Elizabeth Skwarra and Others" (Bull. Mus. Comp. Zool., Harvard, 77 (5): 157–240, fig. 6. Cambridge, 1934). The workers are "glabrous and shining, yellowish red; gaster black; head black behind shading into red on its anterior third; antennae and legs yellow." In life, the head and gaster appear blue-black, and the ants will at once be recognized by their slow and deliberate but purposeful and inevitable movements, as their files move slowly up and down the trunks of coffee and coffee shade trees in fine

weather. During wet weather the ants stay in their tunnels inside the live twigs and branches of the trees, and in the swollen galls which develop on infested coffee trees where the branches come out from the main trunk. Safe within their tunnels they attend the mealybug *Pseudococcus citri* (Risso), and a formless pink soft scale, which, so far as we know, occurs only in hormiguilla tunnels. So devoid of character is this scale that, despite repeated submission to specialists in Coccidae, it was not named until 1922. The correct name for this distended pink "cow" of the hormiguilla is *Cryptostigma secretus* (Morrison), occurring, like the hormiguilla itself only in Puerto Rico. Injury by loss of sap caused by the mealybugs and soft scales attended by the hormiguilla is quite minor by comparison with the direct injury which the ants cause by boring in live twigs and inducing the knotty galls which form on the stems of the coffee trees: an



The "Hormiguilla," *Myrmelachista ramulorum* Wheeler. (Drawn by R. B. Howe.)



The "Hormiguilla," *Myrmelachista ramulorum* Wheeler. (Drawn by R. B. Howe.)

injury directly reflected in greatly decreased yields of coffee berries in the most heavily infested groves. Shade trees are full of dead branches, which keep continually dropping, even when there is not a breath of wind. Even the branches which are still alive are greatly weakened, as indeed is the entire coffee tree, which is easily broken off when the berries are being picked. Dr. Wheeler's types were collected in seagrape (*Coccoloba uvifera*) on the beach of Culebra Island, and at Arecibo, and additional colonies have been noted in this tree at Loíza and Dorado, and on the Island of St. Thomas, high in the hills. Dr. Wheeler also found the hormiguilla at Utuado in "ucar" (*Bucida buceras*), which he calls "torchuelo": a unique record and all the more surprising when one considers how many coffee trees and coffee shade trees in the Utuado region must have been infested at the time he was in Puerto Rico. The "guamá" (*Inga laurina*), and the "guaba" (*Inga vera*), both commonly used as shade trees for coffee in

Puerto Rico, are possibly most often and most heavily infested with the hormiguilla, but mango, orange, "pomarrosa" (*Eugenia jambos*), "jobillo" (*Spondias purpurea*), and "tulipán" or African tulip tree (*Spathodea campanulata*), present in the coffee groves, also serve as hosts. Colonies have been found in hollow twigs and empty burrows of the caterpillars of *Agathodes designalis* Gueneé in the shoots of the "bucare" (*Erythrina berteroana*) at Arecibo, and in crevices in the bark of *Erythrina poeppigiana* at Aibonito, by Dr. Luis F. Martorell. The trees of *Triplaris cumingiana* on the Station grounds at Río Piedras are infested, the ants living under the loose bark scales, but no other trees nearby are known to be infested. In the countries where this is a common endemic, because it so often harbors ants, it is called "hormiguero" (Costa Rica), "palo hormiguero" (Panama), or "bois fourmi" (French Guiana) and "formigueira" (Brasil), the species of ant harbored, however, in none of these countries being the hormiguilla of Puerto Rico. Under the loose bark scales of "tortugo amarillo" (*Sideroxylon foetidissimum*) at Isabela, large colonies exist. The twin jagüey tree (*Ficus stahlii*), close beside the road between Manatí and Ciales, is heavily infested, and because of ready availability, has been the scene of innumerable experiments in attempts to control. Possibly the most obvious direct injury to any tree caused by the hormiguilla is to be seen on some "pomarrosa" trees, besides the road between Lares and Adjuntas, of which all the new shoots are killed before they become as much as a foot long, but remain attached with dry, shriveled leaves. On coffee and guamá trees at an elevation of 2,700 feet in the Maricao Forest, infestations of hormiguilla were as serious as lower in the commercial groves. Experiments conducted by Mr. R. H. Van Zwaluwenburg, when he was Entomologist at the Mayagüez Station, in the use of shade trees for coffee which would not become infested with the hormiguilla, indicated that bananas do not harbor the ant, but can be used only for small trees as temporary shade. Every large tree suitable for coffee shade, eventually became infested.

Of natural enemies, the hormiguilla has very few, Dr. Alex. Wetmore finding these ants only in the stomachs of the woodpecker. The grass lizard, *Anolis pulchellus*, and all arboreal lizards eat the hormiguilla, which indeed constituted 12 per cent of the total food of *Anolis stratulus*. As many of these lizards were collected on or near trees infested with the ants, it is possible that the results are somewhat affected by this accident of collection. Yet to try to find the exceptional areas in the western end of the Island where coffee groves are not infested would also give a distorted picture of the normal food habits of these arboreal lizards.

Until the most recent past, extensive experiments in the use of more direct methods of chemical control have been only very partially success-

ful. The basis of all experiments has been an observation made in the coffee groves at Lares of the ants feeding on dead spiders and insects, and even on bird dung. The honeydew obtained from their mealybugs and soft scale insects is by no means a balanced diet, and they crave proteins. Bits of meat or cheese are soon covered with ants, and it was thought that it might be possible to kill them by poisoned meat baits. Of the numerous poisons tried, thallium acetate was the most successful, but altho Hamburg steak mixed with water-soluble compounds of thallium had no effect on the bark of the jagüey tree at Ciales, it proved to be very toxic to coffee and coffee shade trees. The fumes of cyanide mixed with meat overpower the ants so rapidly that they fall from the tree, and soon after recover, but when the meat is modeled into a little shelf, it becomes covered with their dead bodies. Unpoisoned meat placed over an open container for cyanide is even more attractive, but the containers fill with water, as well as with dead ants, and in a test run for a month with daily replacement of the bait, the number of ants on the tree showed no apparent diminution. All of these methods are moderately effective, but none is commercially practical.

As soon as adequate supplies of DDT were available after the end of World War II, preliminary experiments were made in spraying this new chemical on hormiguilla-infested trees. Small-scale preliminary tests showed that applied as a 5% solution in kerosene, it was very effective in killing the ants. The trunk of the jagüey tree at Ciales was completely cleared of hormiguilla at the first spraying, and none started to return for over six months. The upper, unsprayed part of the tree was still full of ants, however, but none even attempted to descend to the ground along their runways on the outside of the trunk. Testing 5% DDT in kerosene on mango and orange trees in coffee groves, all ants were killed on the parts of the tree sprayed, and none invaded these parts of the trees. When applications were made on coffee and coffee shade trees, the 5% DDT in kerosene was equally effective in killing the ants, but it proved toxic to the young leaves and shoots of the coffee trees. When DDT dust was used it had no apparent effect on the ants, and spraying with a water suspension of DDT, altho partially effective in killing the ants, and entirely non-toxic to the tenderest leaves and shoots, has only a very temporary effect in keeping the ants from returning to the sprayed areas.

Tests with a 1% water suspension of aldrin (Hyman 118) show that this newer chemical is as toxic as DDT to the ants, its residual effect lasts for months, and it is not injurious to even the tenderest foliage. Dilutions of one-half and one-quarter percent will kill hormiguilla, but the residual effect is quite temporary, and it is not to be recommended. Airplane application during the dry winter months to all hormiguilla-infested groves of 1%

aldrin should greatly aid in the rehabilitation of the local coffee industry by eliminating a most serious insect pest, not present in other coffee-producing countries.

SPHECOIDEA: Crabronidae

Ectemnius craesus (Lepeletier) is a little black and yellow wasp, first collected in Puerto Rico by Dr. Gundlach, who noted of his specimens: "Los ejemplares de Puerto Rico difieren en algo del tipo cubano—en el color de la pubescencia." Actually the pubescence is barely perceptible, the wasps appearing bright and shiny black, with yellow pronotum, yellow dorsal band posteriorly on the scutel and on the metanotum, one on the median and the post-terminal segments of the abdomen, and the legs yellow. Two adults emerged from a tunnel in a rotten log at Río Piedras, and one has been collected at Guayama. Mr. E. G. Smyth has specimens from Mona Island, but none has been found there since.

Ectemnius mayeri, described as a *Crabro* by Dr. Hermann Dewitz (1881–201) from specimens collected by Dr. Gundlach "en los contornos de Mayagüez," has not since been found.

Cerceris krugii, described by Dr. Hermann Dewitz (1881–201) and named for the German consul at Mayagüez, occurs, according to Dr. Gundlach "en varias localidades", but has not since been collected anywhere in Puerto Rico, altho Dr. Alex. Wetmore found the remains of a wasp identified as a species of *Cerceris* among the stomach contents of a Jamaican vireo.

Cerceris margaretella, included by Mr. S. A. Rohwer in his "Descriptions of New Species of Hymenoptera" (Proc. U. S. National Museum, **49** (2105): 205–249. Washington, D. C., July 16, 1915), the type material, three males collected by Dr. C. W. Hooker at Mayagüez, is close to Cresson's *Cerceris festiva* from Cuba, but may be distinguished by the "different colored antennae and the yellow propodeal enclosure." The Cuban species is "black, feebly punctured; face, collar, tegulae, spot beneath wings, scutellum, a longitudinal spot on each side of the metathorax, four anterior legs, basal two-thirds of hind tibiae and apex of the four basal segments of the abdomen, yellow."

Psen (Mimesa) modesta Rohwer (1915–244) is an endemic, entirely black wasp, except for pallid tarsi and silvery pile on some parts of the body, the "wings dusky hyaline, iridescent; veination dark brown." The types were three males from Mayagüez, "no collector given." It has not since been found in Puerto Rico. Malloch (1933) places it in the subgenus **Mimumesa.**

Trachypus gerstaeckeri Dewitz (1881–202), of which the type was collected by Dr. Gundlach at Mayagüez, has not since been found.

Nyssonidae

Nysson (Brachystegus) basirufus Rohwer (1915–247) is a black wasp with dense pubescence on the body, only the posterior legs rufous, described from a single female collected by Dr. C. W. Hooker at Mayaguez. It has not since been found.

Hoplisus (Hoplisoides) scitulus (Cresson) was the determination given by Mr. S. A. Rohwer to Mr. Thos. H. Jones of a wasp which he collected emerging from a tunnel in the sandy bank of the railroad to Trujillo Alto. This black wasp, extensively spotted with yellow, originally described from Cuba in the genus *Harpactus*, was first collected in Puerto Rico by Dr. Gundlach. It has since been intercepted on mulberry tree at Arecibo. It is characterized by "the large yellow spots on the matathorax."

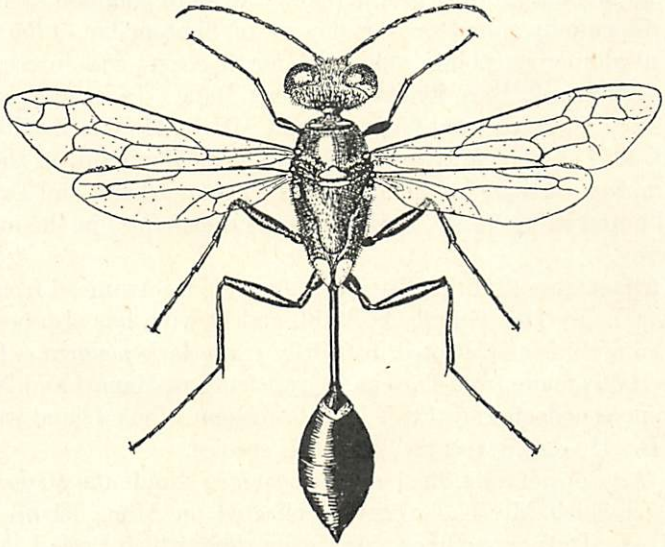
A wasp collected on Mona Island by Prof. J. A. Ramos (1947–67) has been identified by Dr. H. K. Townes as a species of **Trypoxylon.**

Sphecidae (Larridae)

Prionony x thomae (F.) is a large, slender, black wasp, with elongate black petiole, bright chestnut-red gaster, with its face, top of pronotum and mesonotum laterally densely covered with light golden pubescence. Its color pattern almost exactly parallels that of the introduced changa parasite, *Larra americana* (Saussure), and when observations were being made on the dispersion of the latter in Puerto Rico, *Prionony x thomae* was often noted on the flowers of "botoncillo" (*Borreria verticillata*) in the regions to which *Larra* had not, at the time, penetrated: Fajardo, Luquillo, Mameyes, Laguna San José, Dorado, and all along the north coast close to the beach, to Quebradillas, Isabela and Aguada. It has repeatedly been collected on the airport of Mona Island, where it is possibly more abundant than anywhere in Puerto Rico. A dead adult was found in a salt-pool at Guánica, and interceptions have been made at Ponce, Santa Isabel and Salinas. A female carrying a grasshopper larger than herself was noted at Isabela. At Naguabo, one digging in a ditch in a cane field was observed to make a hole larger than herself in a few minutes. On the same scale, a man with tools would require the better part of a day to make as large a hole. This wasp is listed by Drs. Gundlach and Stahl, and Dr. Wetmore found it eaten by the kingbird.

Ammobia ichneumonea (Linn.), variety **auriflua** (Perty), under the names of *Sphex croesus* F. and *Sphex auriflua* Perty was listed from Puerto Rico by Drs. Gundlach and Stahl, and as a *Sceliphron* by Ashmead. It is one of the largest wasps to be found on the Island: black with long golden pubescence, the basal half of the gaster and the legs being bright yellowish brown. Altho at times found near the coast, it is much more characteristic of the higher mountains: in the Luquillo and Maricao Forests, and of the higher coffee groves, at Lares, Las Marías and Orocovis.

Ammobia singularis (F. Smith) is considerably smaller and more common along the coast, having been noted repeatedly on the flowers of *Borreria verticillata* and *Hyptis atrorubens* when determining the spread of *Larra americana* in the humid regions where the changa is abundant. It has been intercepted at Guánica and Salinas, and occurs on Mona Island. Mr. Thos. H. Jones at Río Piedras found a grasshopper, *Conocephalus fasciatum* DeG., in the burrow of this wasp. It was not listed by Drs. Gundlach or Stahl, the earliest record for Puerto Rico being in Mr. R. H. Van Zwaluwenburg's list (P. R. 93) as *Chlorion dubitata* Cresson. "From a study of the specimens from various localities" made by Miss Grace A. Sandhouse, "it is evident that these are conspecific, but the synonymy has not been published."



Sceliphron assimile Dahlbom (from Haiti). Three times natural size. (Drawn by F. Maximilien.)

Sceliphron caementarium (Drury) is the most "thread-waisted" and slender of the large mud-dauber wasps. It is apparently a recent introduction from continental America, as Drs. Stahl and Gundlach have no record of its occurrence here. Mostly black or very dark brown in color, with extremely long and slender legs and abdominal petiole, it was first noted in Puerto Rico on the walls of a house in Santurce in September 1924, by Mr. José I. Otero, who found its nests, made mostly of sand, 35mm. long and 12mm. wide, provisioned with at least three kinds of spiders. Subsequently, females have been found building nests, invariably provisioned with spiders, at Bayamón, at Manatí under a nearly horizontal coconut palm, and at Aibonito in the concavities of a big rock.

They have been intercepted at San Juan and on crotalaria flowers at Manatí, noted in 1937 at Villalba on a guava bush, and on corn plants at Mayagüez in the same year.

Tachysphex sp. was the identification by Miss Grace A. Sandhouse of a wasp intercepted at San Juan.

Dr. Gundlach listed five species of *Larrada* from Puerto Rico, and Drs. Stahl and Dewitz, four, or which two: **fuliginosa** Dahlberg and **luteipennis** Cresson have not since been found in Puerto Rico. Subsequently called *Notogonidea*, and at present **Motes,** these all black wasps, with short whitish pubescence or bloom, wings yellow or hyaline with iridescent reflections, no abdominal petiole, are characterized by a transverse ridge on the front below the anterior ocellus.

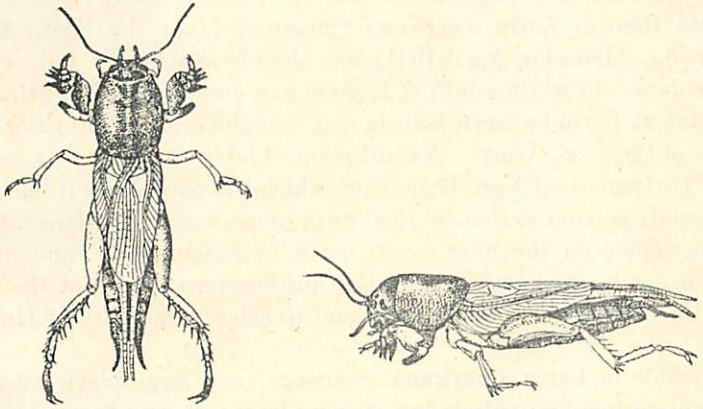
Motes ignipennis (Smith) is apparently the more common species, having been repeatedly noted on the flowers of "botoncillo" (*Borreria verticillata*) at numerous points along the north coast, and intercepted on crotalaria flowers at Barceloneta and Vega Baja. In cane fields it has been collected at Coloso and Guánica, and Mr. R. H. Van Zwaluwenburg lists it (P. R. 71) from Mayagüez. It was very abundant on the flowers of *Heliotropium indicum* at the airport on Vieques Island, and Dr. Luis F. Martorell noted it on "fresa" bushes (*Rubus rosaefolius*) in the mountains above Cayey.

Motes trifasciatus (Smith), listed as a *Larrada* by Ashmead from Puerto Rico as well as by Drs. Gundlach, Stahl, and Dewitz, has also been determined from specimens collected in fruitfly traps as *Leptolarra*. Interceptions have been made from flowers of grapefruit at Manatí and Naguabo. The specimens collected by Prof. J. A. Ramos on Mona Island were identified by Dr. H. K. Townes as "like" this species.

Mr. S. A. Rohwer identified as *Notogonidea* **vinulenta** (Cresson) the black wasps which Mr. E. G. Smyth collected on Mona Island in 1913, and Dr. H. K. Townes as "like" this species those which Prof. J. A. Ramos collected there more recently. It is listed as a *Larrada* by Dr. Gundlach from Puerto Rico, and has been intercepted on grapefruit flowers at Barceloneta.

Tachytes insularis Cresson, a plain black wasp with clear, transparent wings, extensive silvery bloom, especially on the legs, and a much hairier front, with no transverse ridge or raised inner margin of the eyes, was listed by Dr. Gundlach as "rara," but innumerable recent collections would indicate that it is only more wary: too swift of movement to be caught without a net. Miss Grace A. Sandhouse states (in correspondence) that "from a study of the specimens of the genus from Puerto Rico it appears that a single species is involved, and, according to the material in the collection, the name should be *insularis* Cr., rather than *argentipes*

Sm. However, the types would have to be seen to verify this." This black wasp has been noted in large numbers on the flowers of *Heliotropium indicum* on Vieques Island, and observed innumerable times on the flowers of "botoncillo" (*Borreria verticillata*) near the beach along the north coast of Puerto Rico. It has been intercepted on crotalaria flowers at Arecibo and Barceloneta, on mango flowers at Mayagüez and on young corn plants at Aguadilla. First collected on Mona Island in 1913 by Mr. E. G. Smyth, it has repeatedly been seen since on the ground at the airport. Noted resting on guava bushes at Sabana Grande, this appears to be its nearest approach to the xerophytic regions of Puerto Rico, but it also is not well adapted to a very humid environment, for it has been found by Mr. Ovidio García killed by an entomogenous fungus resting on the leaf of a forest



The Host of *Larra americana* (Saussure): the Puerto Rican Mole-Cricket or "Changa," *Scapteriscus vicinus* Scudder. One and one-half times natural size. (After Barrett.)

tree at Río Abajo Plantation, at an elevation of 1,200 feet above sea-level at Arecibo. This fungus was identified by Miss Vera K. Charles as *Cordyceps sphecocephala* (Klotzsch) Massee. It had produced a curved stipe growing out of the apex of the abdomen of the wasp, several time the length of the dead insect. At the end of the stipe was a pointed fruiting head.

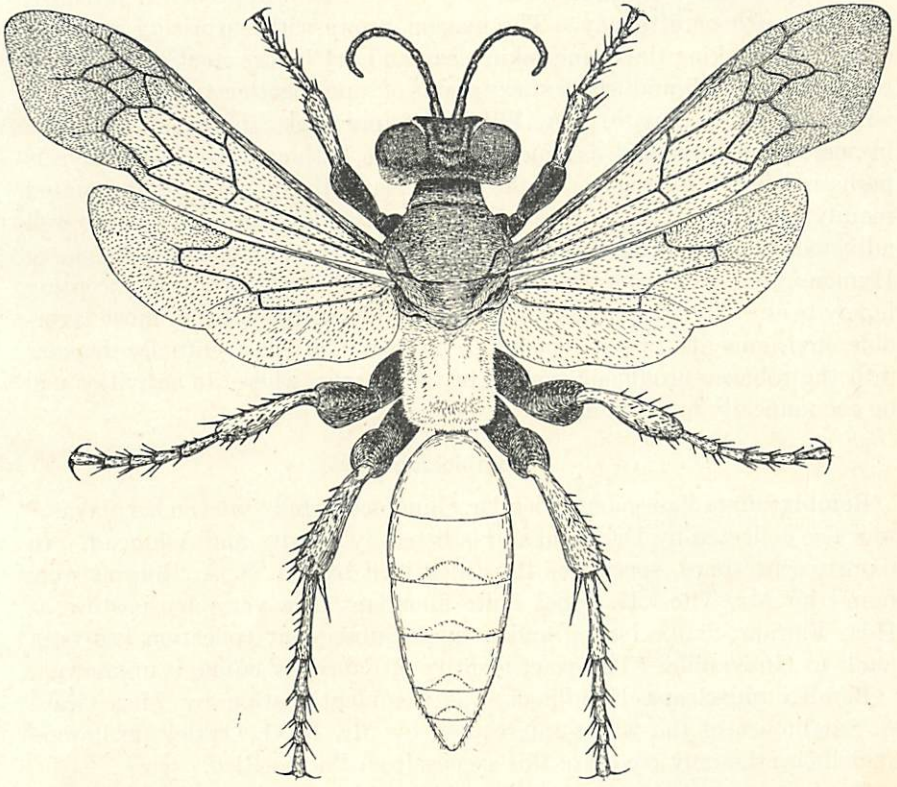
Dr. Francis X. Williams in recording his "Studies in Tropical Wasps—Their Hosts and Associates" (Entomological Series Bulletin No. 19, Hawaiian Sugar Planters' Association Experiment Station, pp. 179, fig. 16, pl. 33. Honolulu, January 1928), gave the first intimation of effective parasitization of the Puerto Rican changa. His beautifully accurate drawings (pl. V, p. 43) and extensive observations on the habits and abundance of this parasite at Belém, Pará do Brasil, greatly simplified the initiation of the project of "The Introduction into Puerto Rico of *Larra americana*

Saussure, a specific Parasite of the 'Changa' or Puerto Rican Mole-Cricket, *Scapteriscus vicinus* Scudder" (Jour. Agr. Univ. P. R., **22** (2): 193–218, fig. 4, ref. 16. San Juan, April 1938) in February 1936. What Dr. Williams probably never imagined was that the "Presence of Host Keeps Parasites alive in Captivity" (Science, **87** (2259): 352. New York, April 15, 1938), and that accompanying the live wasps with freshly parasitized changas, each in a separate can inside the container with the wasps, permitted 83.7% of the wasps to reach Puerto Rico alive and vigorous, as compared with a mortality of over nine-tenths of the wasps when they were sent from Belém unaccompanied by live hosts. The live changas, each bearing an egg of the parasite on the softest and most delicate part of the underside of its body, just behind the first pair of legs, were released, together with the live wasps, at six different points. "The Establishment in Puerto Rico of *Larra americana* Saussure" (Jour. Ec. Ent., **34** (1): 53-6, ref. 8. Menasha, April 1941) was already assured by January 1939 at two points: (1) to the south of Laguna San José, near Río Piedras, and (2) at Maleza Farm between Isabela and Aguadilla, now Punta Borinquen Air Base of the U. S. Army. A third point of later establishment was near Laguna Tortuguero at Vega Baja, from which three localities it has spread by natural dispersion so that by 1946 its presence was definitely established from Mayagüez on the west coast, north to Aguada and Aguadilla, all along the north coast and around the northeastern corner of the Island and south to Humacao Playa and inland to the municipality of Humacao itself.

The female of **Larra americana** (Saussure) is a large black wasp with golden pubescence, no petiole but shining bright chestnut gaster, considerably exceeding in size and brilliance the comparatively small and dull male. In the Amazon region, the Guianas, Venezuela and in Puerto Rico, the adults frequent the flowers only of *Borreria verticillata* (L.) Meyer and *Hyptis atrorubens* Poit., the common name for both species in Puerto Rico being "botoncillo." At Belém, the females have a very definite daily cycle during the months before and after the rainy season, searching for changas early in the morning, and only frequenting flowers from 10 o'clock to midday, most abundantly just before the heavy daily rainfall which normally occurs shortly after noon. Rarely are they to be seen on flowers in the afternoon, and practically never on flowers when the sun is obscured by a cloud. In the brightest and most intense sunshine, they promptly observe the advance of the collector, and prove to be most difficult to catch, changing their position so that both eyes are towards the intruder, and taking flight at the first movement of the net. In Puerto Rico, they prove to be noticeably less wild, and, with a less definite daily cycle of rainfall, may be observed in the early afternoon, but only on the

same flowers which they frequent on the continent. So far as we know, the female wasps attack only *Scaptericus vicinus* Scudder, being obligate parasites on that one species: the Puerto Rican changa.

Changas may most readily be found when heavy rainfall has saturated the soil with water, forcing them to burrow close to the surface, and, at times, to run clumsily about on top of the soil, where they can be most readily pounced upon by the female wasp. "These Pará *Larra*," as observed by Dr. Williams (1928-47), "sting their victims in a systematic



Female of *Larra americana* (Saussure), about six times natural size. (Drawn by F. Sein.)

manner: first, one or more stings are administered in the center between the third and second pair of legs, then between the second and first pair, and here perhaps most time is employed, and finally, beneath on the mouth parts or cheeks." As soon as the bluntly crescentic egg is laid, the wasp promptly ceases to be interested in the changa which she has just parasitized, which is usually able to stagger off, unless attacked meanwhile by

another wasp. In captivity and in nature, the wasps fight fiercely over possession of a changa, so that to obtain least stung mole-crickets with but a single parasite egg, it was customary to remove the changa with a single wasp from the general cage, and place them in a large glass vial until oviposition was completed. "Oviposition varied from one to three per day, and the intervals were usually considerable. One might conclude," continues Dr. Williams, "that not more than one or two ripe eggs are to be found at one time in her ovaries." The egg, pink at first, becomes somewhat swollen and dull grey in color as it approaches hatching, on the fourth or fifth day. The maggot grows with surprising rapidity, eventually sucking the changa skin clean and dry before starting to secrete the dark viscous liquid which sticks grains of sand together to form a cocoon within which to pupate. Dr. Williams found that "the entire life cycle in some cases occupied as much as 65 days, although about 50 days is perhaps a better average. All the wasps issued in the morning and mated readily in captivity." In Puerto Rico, *Larra* appears to have become well adjusted to local conditions, and at times is the most abundant large Hymenopterous insect to be seen on botoncillo flowers, not even excepting honey bees. To date, it has spread mostly along the coast, in most favorable environments, and it remains to be seen if it will eventually disperse into the tobacco-producing regions of the interior where its activities will be economically most valuable.

Bembicidae

Bembix ciliata Fabricius, which Dr. Gundlach noted "vive en las playas," was also collected by Dr. Stahl and is listed by Dewitz and Ashmead. In more recent times, specimens thus identified by Mr. S. A. Rohwer were found by Mr. Thos. H. Jones quite abundant in a very dry pasture at Hda. Florida, Santa Isabel, and a single subsequent collection has been made at Guayanilla. "The exact identity of Fabricius' *ciliata* is unknown."

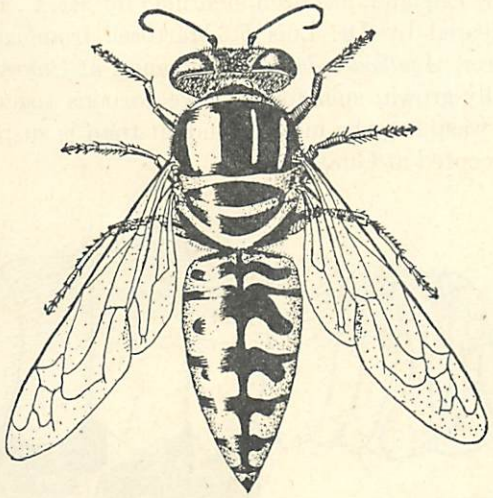
Bembix muscicapa Handlirsch was the identification by Miss Grace A. Sandhouse of the wasps intercepted by Mr. R. G. Oakley on flowers at Salinas: the only record of this species from Puerto Rico.

Bembex regularis Cresson, presumably a MS name, was listed by Dr. Stahl.

A single specimen of what Miss Grace A. Sandhouse identified as **Bicyrtes spinosa** (F.) was collected by Dr. Luis F. Martorell on the weeds at Sardinero Beach, Mona Island.

Stictia signata (L.), listed by Ledru from Puerto Rico in 1797 as a *Bembex*, and subsequently by Drs. Stahl and Dewitz, is twice as large as any of the above, and much more abundant. As *Monedula*, Dr. Gundlach noted it as "común en terrenos arenosos, cavando allí hoyos con mucha prontitud. Apenas se le ve posarse, pues vuela prontamente como juge-

teando un individuo con otro." Dr. Stuart T. Danforth, in describing the environment of the "Birds of the Cartagena Lagoon" (Jour. Dept. Agr. P. R., **10** (1): 1–136, fig. 45, ref. 41. San Juan, January 1926), tells of these wasps catching flies, and living in holes in the clayey soil around the margin of the lagoon. He had specimens from Cartagena Lagoon, and also from Yauco, Juncos and Mayagüez, for this wasp is locally abundant all around the coast of Puerto Rico, as well as on Mona Island. Dr. Luis F. Martorell noted it at Playa de Pájaros, Uvero, Rancho Grande, Sardinero and in the forest of the interior of Mona Island. Presumably catching flies, he records it "flying over cow dung, and over rotten papaya fruits and over food in putrefaction, and, at times, very annoying to people, sometimes two or three of these wasps buzzing about a person."



Stictia signata (L.), three times natural size. (Drawn by F. Maximilien.)

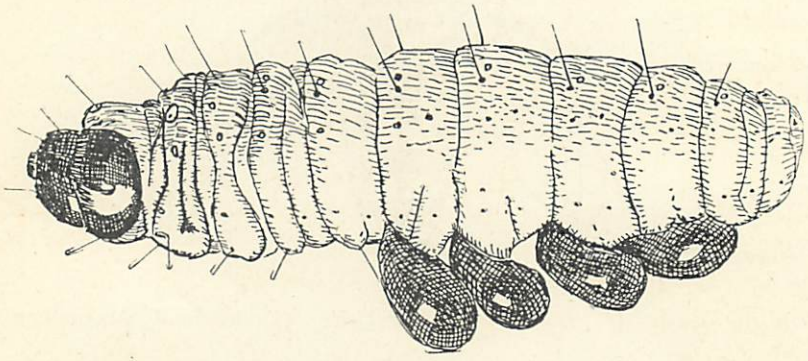
To provision their nests in the soil, usually sandy, where their young are reared, they catch flies of all kinds. Often this means house flies, attracted to molasses, but they also have been noted bothering horses which were being bitten by the Tabanid flies, *Chrysops variegata* (DeGeer), being much more disturbing to the horses than the flies that were sucking their blood. The wasps also come to flowers, having been intercepted on crotalaria flowers at Arecibo and on "icaco" (*Chrysobalanus icaco*) flowers at Dorado, but they rarely come to those of botoncillo, despite the abundance of this weed in the sandy areas frequented by the wasps.

Microbembex monodonta (Say) is a much smaller species with an extensive continental distribution, but in Puerto Rico found mostly in the western end of the Island. It has been collected on botoncillo blossoms at Vega Baja, and has repeatedly been intercepted on sandy beaches near

San Juan and in a pepper field at Loíza. "It is 8–14 mm. long," according to Dr. E. O. Essig (1926-876), "black, the abdomen wholly yellow or with 1 to 5 black bands, the wings often infumated. It nests in sandy places and makes a single burrow which is provisioned with dead insects which are gathered on the sands, and does not follow the general practise of capturing live prey and paralyzing it in order to provide a fresh supply of food for the young. The nests are not provisioned until the eggs hatch, after which new stores are brought over a period of several days."

VESPOIDEA: Bethylidae

Goniozus platynotae Ashmead, a small, shining black wasp, 3.0 mm. long, with mandibles, antennae and legs honey-yellow in color, found as far north as New England, has been identified by Mr. C. F. W. Muesebeck as a parasite reared by Dr. Luis F. Martorell from caterpillars of the bucare stem-borer, *Agathodes designalis* Guenée, at Cayey. The parasitic grubs, when fully-grown, spin four or five cocoons together in a fold in the leaf. This wasp may be more abundant than is suspected, for adults have been intercepted at Guayama.



Larvae of *Parasierola* prob. *cellularis* (Say), feeding on caterpillar of *Fundella pellucens* Zeller. Fifteen times natural size. (Drawn by G. N. Wolcott.)

Parasierola nigrifemur (Ashmead), as determined by Mr. C. F. W. Muesebeck, has been reared from a caterpillar of *Pyroderces stigmatophora* (Walsingham), at Isabela. Five opalescent rounded maggots on one host in an old cotton boll attained full growth in a few days, and spun brownish cocoons underneath the empty caterpillar skin, from which the black, ant-like adults emerged a week later. This, or a very similar species, has been reared from pink bollworm larvae at Mayagüez, and also from larvae of *Kearfootia*. Among the dead insects collected from the cotton ginnery at Isabela, after its interior had been sprayed with 5% DDT in kerosene, was one specimen of this genus. The continental species, **Parasierola cellularis** (Say), or on every near, according to Mr. A. B. Gahan, was reared

from the larva of *Fundella pellucens* Zeller, one of the lima bean pod-borers, at Isabela.

Dr. Donald De Leon reared from the stems of *Derris eliptica* infested with Cerambycid or Bostrychid larvae at Río Piedras, a wasp which was identified as a species of **Plastanoxus.**

Dryinidae

"A Dryinid Parasite attacking *Baldulus maidis* in Puerto Rico" (Jour. Agr. Univ. P. R., **22** (4): 497. Rio Piedras, October 1938) which Dr. Kenneth A. Bartlett found at Mayaguez, was identified as a new species of **Gonatopus** by Mr. C. F. W. Muesebeck. The same identification by Mr. Muesebeck was of wasps reared from cocoons on cane leaves at Río Piedras by Mr. Thos. H. Jones in 1912, and most recently Prof. J. A. Ramos (1947-64) found a **Gonatopus** on Mona Island.

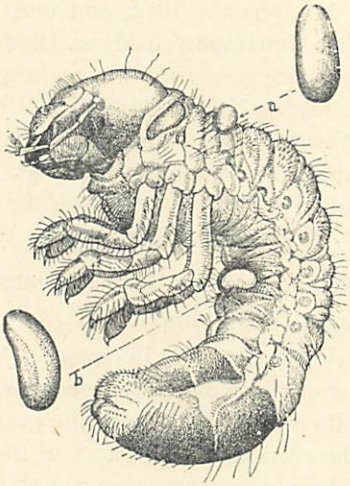
Fish scale-like cocoons on grapefruit leaves accompanying heavy infestations of *Ormenis infuscata* Stål at Manatí in 1933 had emerged from them three species of wasps, one of which Mr. A. B. Gahan identified as a new species of *Spilochalcis*, but the one which Mr. C. F. W. Muesebeck thought to be an undoubted primary parasite on the Fulgorid he identified as "? gen. nov., sp. nov. Lestrodryinini, subfamily Anteoninae."

Scoliidae: White Grub Parasites

Before the giant Surinam toad, *Bufo marinus* (L.), had been introduced into Puerto Rico, and white grubs were the major pest of every agricultural crop, the habits of the endemic Scoliid wasps were most intensively studied because the female adults lay their eggs on white grubs and their larvae are parasitic on them. The economic importance of these wasps is shown by the normal scarcity of their hosts where they are abundant, and conversely the enormous abundance of injurious species of white grubs in Puerto Rico which are attacked by no common endemic Scoliid. Indeed, the importation of the Surinam toad was so overwhelmingly successful mainly because it had practically no competition (except its own ever increasing numbers) for what seemed to be an inexhaustible supply of food.

Myzine haemorrhoidalis (Fabricius), listed from Puerto Rico by Drs. Gundlach, Stahl, Dewitz and Aldrich as *M. sexcincta* Fabricius, and by Mr. D. L. Van Dine as *Elis sexcincta* Fabricius, is probably the most abundant Scoliid wasp to be found in Puerto Rico. The female is black, marked with yellow, the yellow bands of the abdomen being interrupted so that a continuous black stripe extends down the center of her back. The males are very slender, marked and banded with yellow, and sometimes cluster in large compact masses on low vegetation, such clusters containing not a single female. In an account of the "Insect Parasite Introductions into Porto Rico" (Jour. Dept. Agr. P. R., **6** (1): 5–20, fig. 7. San Juan, October 1922), the host is given as "*Lachnosterna* (*Phytalus*) *insularis* Smyth."

This is *Phytalus* (now *Clemora*) *apicalis* Blanchard. Both sexes of the wasp have been reared from cocoons collected in a plowed field between Palo Seco and Pt. Salinas, February 24th, 1922, in the outer threads of which were entangled the shriveled remains of small white grubs, identified on the basis of their skulls and mandibles as being the third instar larvae of this small May beetle. Such grubs, when alive and healthy, weigh from three to six times as much as do the wasps parasitizing them. Mr. Harold E. Box, at the time that he was employed by Central Aguirre, in his account of "Porto Rican Cane-Grubs and Their Natural Enemies" (Jour. Dept. Agr. P. R., 9 (4): 291–356, fig. 21, ref. 15. San Juan, October 1925), narrates of this wasp how "during February and March, 1200



A continental White Grub, showing position of parasitic Scoliid eggs: *a*, *Tiphia punctata* Rob., *b*, *T. transversa* Say, and eggs much enlarged. (After Davis.)

females were collected, and released in another hacienda where *Phytalus* grubs were known to be common in certain fields, but where hitherto no signs of the presence of the parasite had been noted, with the result that on the 3rd of April they had accounted for 7% of the *Phytalus* grubs, while three weeks later, parasitism had amounted to 26%. During late May and early June, the parasites were more abundant in their new quarter than in the locality from which they had been taken."

The females of *Myzine haemorrhoidalis* are fond of honeydew, and have been noted obtaining it from *Aphis gossypii* Glover on cotton at Isabela, and from the soft green scale, *Coccus viridis* Greene, on grapefruit at Isabela and on "palo de muñeca" (*Rauwolfia tetraphylla*) at Aguadilla. Both males and females are often to be seen in the greatest abundance on the

common flowers of the sandy land along the beach, and are possibly attracted in greatest numbers to those of "botoncillo" (*Borreria verticillata*). The flowers of seagrape (*Coccoloba uvifera*) at Arecibo and of "ucar" (*Bucida buceras*) on Vieques Island have been noted swarming with these wasps. On Mona Island Dr. Luis F. Martorell noted them on the flowers of "abeyuelo" (*Colubrina ferruginosa*) and "corcho" (*Pisonia albida*), and at Santa Isabel on imported tamarisk trees. Apparently the wasps are almost equally abundant on the north and south coasts of Puerto Rico. Their presence on Mona Island presumably indicates that they there parasitize the endemic small May beetle, *Abcrana monana* (Moser), and their presence on Vieques indicates that *Clemora apicalis* (Blanchard) is present there.

Only the flycatcher is noted by Dr. Wetmore as having eaten this wasp. Females have been found in the stomach of the lizard *Anolis cristatellus*. Much more serious in reducing their numbers is parasitism by the common Bombyliid fly, *Anthrax gorgon* F., reared from a sixth of the cocoons found between Palo Seco and Pt. Salinas.

Myzine ephippium (Fabricius) has males and females differing so greatly in general appearance that each has subsequently been redescribed: the slender male as *Myzine apicalis* by Mr. Cresson (1865–117) "black; length $5\frac{3}{4}$ lines; legs and apical margins of abdominal segments, yellow or ferruginous"; the plump female as *Elis xanthonotus* by Mr. S. A. Rohwer (1915–234) "length 14 mm., readily distinguished by its black color and yellow mesoscutum," which in life and usually even in museum specimens is a bright chestnut red, the type specimen having been collected at Río Piedras by Mr. Thos. H. Jones. Dr. Gundlach, listing the female as "rara," and the male, under Cresson's name, as "común," adds "acaso sea la misma que *M. ephippium* Fabr." This would seem the reverse of the present status of the sexes, for the females are often observed on the flowers of "botoncillo" (*Borreria verticillata*), and the males less often. Mr. E. G. Smyth's version is that "the female wasps occur on the flowers of *Hyptis atrorubens*; the males on *Mitracarpus portoricensis*" (=*Borreria verticillata*). Females have been noted on the flowers of *Cordia corymbosa* at Mayagüez, and on the flowers of the yellow caltrop (*Tribulus cistoides*) at Puerta de Tierra, and both sexes intercepted in grapefruit groves at Dorado and Garrochales.

"This is one of the Scoliids whose distribution in Porto Rico, so far as known, is confined to the north of the Island," according to Mr. Harold E. Box (1925-336), but it remained for another English Entomologist, Mr. Walter F. Jepson, working with headquarters at Treasure Island, Cidra, in his "Report on the Search for Parasites for *Phytalus smithi* Arr." (pp. 66, Port-Louis, Mauritius, 1936) to most exhaustively study its habits. "Both males and females frequented (the flowers of *Borreria verticillata*) to

the exclusion of all others. As soon as the sun temperature approached 80°, i.e. about 9:30 a.m., the females of this species could be found crawling from flower to flower, and making short flights to nearby plants. Within a few minutes of the sun becoming obscured, not a specimen could be collected, and no emergence took place on rainy days. By 1:30 p m. all females had disappeared, and males could be found congregating round the flower heads. The females lived in captivity, with average care, for a month or more; two specimens were kept for over 60 days." Mr. Jepson induced oviposition on the third instar grubs of *Lachnosterna* (now *Cnemarachis*) *portoricensis*, *L. vandinei* and *L. citri*, indicating that this is one of the most important of the natural endemic enemies of white grubs in the more humid parts of the Island. "The egg is placed ventrally on the permanently paralyzed host, with its long axis parallel to that of the body of the grub. (After two or three days) the larva hatches and feeds (for eight to twelve days) with its head towards that of the host. The cocoon is very tough and consists of more than twenty separable layers of threads, the outer one of which does not surround the cocoon like fluff, as in the case of the genus *Campsomeris*." Wasps emerge from the cocoons in from 75 to 87 days, making the total period for the immature stages approximately three months.

Dr. Wetmore reports this wasp eaten by the kingbird, but it was not found eaten by lizards or the imported toad. No cocoon has been found in nature, consequently nothing is known of possible parasitism by a Bombyliid fly, but it may be presumed that such parasitism does occur, otherwise this wasp, with such an abundance of hosts for the larval stage, should be much more common.

Campsomeris atrata (F.), the largest of all neotropical Scoliid wasps, and possibly the largest wasp in Puerto Rico, is entirely black except for dark orange and smoky-tipped wings. Listed by Ashmead, and as a *Scolia* by Drs. Stahl and Dewitz, Dr. Gundlach notes "muy común; su vuelo es lento y con ruido visita las flores." This refers to a time when a sparsely settled Puerto Rico was still being cleared of forests from the coastal lowlands, and rotten stumps and the roots of the trees in the soil offered abundant nourishment for the smaller endemic rhinoceros beetle, *Strataegus barbigerus* Chapin, and its grubs, which are the host of the parasitic stage of this wasp. Suggested by the relative size of wasp and grub, this was proved by Mr. Harold E. Box (1925–339), who collected wasp adults in Hispaniola and brought them alive to Puerto Rico, where he was able to induce them to oviposit on rhinoceros grubs taken from the cane fields of Central Aguirre. All the recent records of this wasp are from southwestern Puerto Rico: Aguirre, Ponce, Adjuntas, Lares, Utuado and Mayagüez. But on Mona Island, where *Strataegus barbigerus* is still abundant, Dr.

Luis F. Martorell, in March 1940, found the wasps in considerable numbers: females obtaining nectar from the flowers of such trees as were in flower at that time, mostly "angela" (*Moringa oleifera*), and to a lesser extent "corcho" (*Pisonia albida*) and "abeyuelo" (*Colubrina ferruginosa*).

Campsomeris dorsata (F.), a somewhat smaller wasp, which Dr. Gundlach found "rara," at the present time is abundant in all coastal Puerto Rico. Its larvae are parasitic on the grubs of *Ligyrus cuniculus* (Fabricius), which live on decaying vegetation and cane trash and dead stools in sandy land. Its large, stout-bodied females, black except for two broad, bright chestnut patches on the second and third abdominal segments, are often seen on the flowers of "botoncillo" (*Borreria verticillata*) along the north coast, but are possibly most abundant on those of the yellow caltrop (*Tribulus cistoides*) at Puerta de Tierra and along the Condado beach in the middle of the morning. On the south coast, the flowers of the wild "margarita" or shepherd's needles (*Bidens pilosa*), of "malva de caballo" (*Malachra alceifolia*) and of "abrojo" (*Kallstroemia maxima*) are frequented. Later in the day, the more slender males, with four light yellow abdominal bands, visit the same flowers which the females had monopolized in the morning, and are often present in considerably greater abundance. Over bare ground the males may fly rapidly backwards and forwards, and at dusk may be found gathered in clusters, many being suspended only by their mandibles. This gregarious habit was observed many times by Mr. Jepson (1936–28): "when one male alighted on a plant, it was joined by others coming from all directions. As many as two or three hundred were seen at one time." Dr. Luis F. Martorell noted males in great abundance flying over the sandy soil of a coconut nursery on Mona Island, and subsequently both sexes on the flowers of "angela and "abeyuelo," or resting on the foliage of the introduced beefwood (*Casuarina equisetifolia*).

Mr. H. Bourne, the cane technologist from Barbados for Central Guánica, was possibly the first to record the normal parasitism of the grubs of the wasp on those of *Ligyrus cuniculus*, at that time called *Ligyrus tumulosus* Burmeister. On June 20th, 1913, at Hda. Santa Rita, "when I was getting these grubs, I found 28 cocoons of a wasp, very probably the black one with the two reddish bands across the abdomen, because while digging, two flew out. This wasp is commonly seen in the callejones and cane fields. I also found one grub with a medium-sized larva attached to it, and one with the egg of the wasp freshly laid on its body."

Despite the looseness of the brownish silk forming the outer layer of the cocoon, the layer just beneath the outer network has a decided luster, and the cocoon as a whole is decidedly tough. Those which Mr. Jepson noted as "very fragile" were formed by wasp maggots which had developed on unnatural hosts in the laboratory, and were not at all typical. Of the

adults which he took with him to Mauritius, eleven "traveled for 53 days and then several lived over 40 days after arrival."

The most potent limiting factor for *Campsomeris dorsata* would appear to be scarcity of host grubs. Observations on "The Present Status of White Grub Parasites in Puerto Rico" (Jour. Agr. Univ. P. R., **18** (3): 436–441, fig. 2, ref. 6. Río Piedras, July 1934), some years after Messrs. Box and Jepson had found the wasps so "very abundant" on the south coast, showed the wasp comparatively scarce after the Surinam toad, *Bufo marinus* (L.), had been introduced into Puerto Rico and had become numerous. Mrs. Raquel Dexter discovered, moreover, that not only is the food of the larval stage of this wasp eaten by the toad, but also the male adults of the wasp itself, eight toads having eaten seventy males. Presumably the females move too rapidly to be caught by the toad, but the males may be easily caught when clustered on low vegetation for the night. As the males are greatly in excess of the females in numbers, having some of them eaten by toads does not greatly affect the status of the wasp. No wasps of either sex were found eaten by lizards, but Dr. Wetmore found them eaten by the kingbird, petchary and mockingbird.

Despite the apparently great difference in size of the sexes of *Campsomeris dorsata* there is little difference in their air-dry weight: the males 0.039 gr., the females 0.046 gr. This is only a sixth or a seventh of that of the air-dry weight of fully grown grubs of *Ligyrus cuniculus*: 0.28 gr. Obviously, the wasp maggots are very efficient in transforming beetle grub into wasp, for from the gross weight of the grub must be subtracted its alimentary contents, which is unavailable as food, and also its heavily chitinized jaws, skull and legs, for only the liquid parts of its body can be assimilated by the wasp maggot. Furthermore, in transforming from maggot to adult there is the loss which goes into the formation of the silken cocoon, together with minor one of its larval and pupal skins, all of which must be elaborated out of a single white grub, the only source of food during all the immature stages of the wasp.

Campsomeris tricincta (F.), of which *C. pyrura* Rohwer (1915–235), the type from Mayagüez, is a synonym, has a coarse golden-reddish pubescence on its body and legs, the hairs being especially noticeable on the terminal segments of the abdomen. It was listed by Drs. Stahl and Gundlach as a *Scolia*, and also by Ashmead, without comment as to its abundance. Altho specimens have been collected at Mayagüez and Ponce, or more likely in the mountains behind those cities, most collections have been made at higher elevations: at Adjuntas, Comerío, Cidra, and especially in the Luquillo Mountains, most recently on the flowers of *Clibadium erosum* on El Yunque. Mr. Harold E. Box records it from Mona Island, as well as from Hispaniola. From a female collected on a guava bush Mr. Walter F. Jepson was able to induce oviposition on third instar grubs

of *Lachnosterna portoricensis*. Because of its scarcity, however, he concluded that "the economic status of this species is obviously of no importance."

Campsomeris trifasciata (F.), of similar large size, but lacking the reddish pubescence of *C. tricincta*, with broader and yellower bands on the three anterior abdominal segments, was noted as "común" by Dr. Gundlach, and is listed by Drs. Dewitz and Stahl. Dr. Gundlach's observation as to its abundance is still true, in recent years having been seen in large numbers on the flowers of *Borreria verticillata* and *Hyptis atrorubens* all along the north coast and especially at Yabucoa. At Aguadilla it frequented the flowers of "malvavisco" (*Waltheria americana*), and at Manatí those of *Melanthera confusa*, and has been intercepted on roses and in grapefruit groves at Bayamón, and on crotalaria flowers at Pueblo Viejo. Mr. Jepson found it "common at Cidra, Isabela and Santa Isabel" frequenting many kinds of flowers, and was so easily able to induce females to oviposit on third instar grubs of *Lachnosterna portoricensis* as to suggest this as being the normal host in nature. Dr. Wetmore found that the wasps are eaten by the kingbird and the petchary.

Campsomeris maculata (Drury), listed by Mr. W. H. Ashmead in his "Report on the Aculeate Hymenoptera—of the West Indies," (London, 1900), from Puerto Rico, has not since been collected. According to Mr. S. A. Rower, *Campsomeris druryii* Cockerell is a synonym.

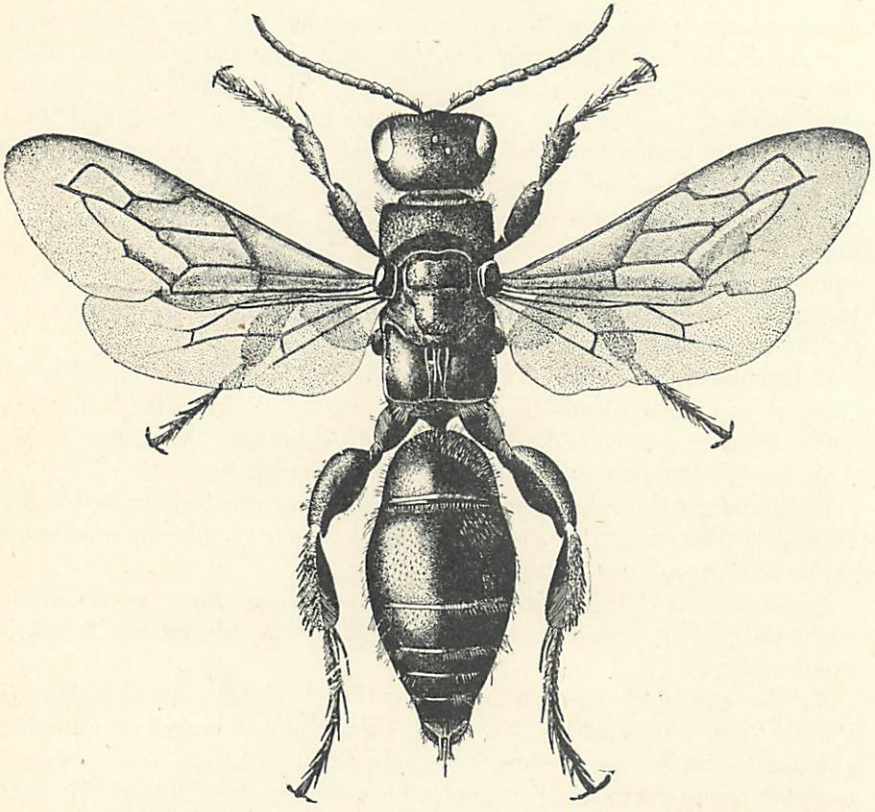
Campsomeris hyalina (Lepeletier), introduced from Venezuela by Mr. Harold E. Box and Mr. Luis A. Catoni, was shortly thereafter collected at Aguirre once, but not subsequently.

Scolia plumipes Drury, listed by Dr. Gundlach as "rara," of which Dr. Stahl claimed to have specimens, is a continental species not found in Puerto Rico.

Tiphia argentipes Cresson, noted by Dr. Gundlach as abundant in Puerto Rico, and listed by Drs. Stahl, Dewitz and Ashmead, is no longer abundant, and so few specimens of these all black wasps have been collected in recent years that it is impossible to be certain of the specific identity of the endemic Puerto Rican form. Mr. E. H. Barrow collected three rather small males on August 16th, 1921 at Hda. Santa Rita, Guánica, feeding on the secretions of a scale, *Pulvinaria psidii* Maskell, on "palo de muñeca" (*Rauwolfia tetraphylla*), and a few weeks later, another small male on the same small tree, and early the next year, one on a cotton plant near Yauco. Subsequently, Dr. Donald De Leon found a single male on a mahogany tree in the Guánica Forest; all of these specimens from the Guánica region are in the U. S. National Museum at present. Small males have been collected at light at Río Piedras, and on sooty-mold blackened guava bushes at Coloso and San Sebastián, and a single small female on Guanajibo Beach near Mayagüez. Dozens of female wasps were ob-

served on guava bushes heavily infested with *Pseudococcus nipae* (Maskell) in the mountains above Villalba in April 1931, but the observer had no means of collecting them, or anything to put them into, and this unique opportunity of obtaining an abundance of material for study was missed.

In the original description of *Tiphia argentipes* from Cuba, Mr. Cresson makes no mention of a "deep preapical grove and prominent median trans-



Adult female of *Tiphia transversa* Say, a continental Scoliid wasp parasitic on white grubs, about six times natural size. (After Davis.)

verse carina" on the first tergite of the abdomen, which is so obvious and characteristic of *Tiphia hispaniolae* Wolcott, noted in the "Description and Biologic Notes on a *Tiphia* from Haiti" (Jour. Agr. Univ. P. R., **22** (2): 189–92. Río Piedras, April 1938), and Miss Grace E. Sandhouse states that it does not occur on the Puerto Rican males in the U. S. National Museum. The males in the collection at Río Piedras are no larger than the smallest ones from Haiti, and the small female from Mayagüez is as

large as the smallest females from Kenscoff, but in all the transverse carina is much less noticeable, or absent. Thus, until Cresson's type can be compared with material from the other West Indies, one may tentatively use the name of the Cuban species for that found in Puerto Rico, altho it is presumably incorrect.

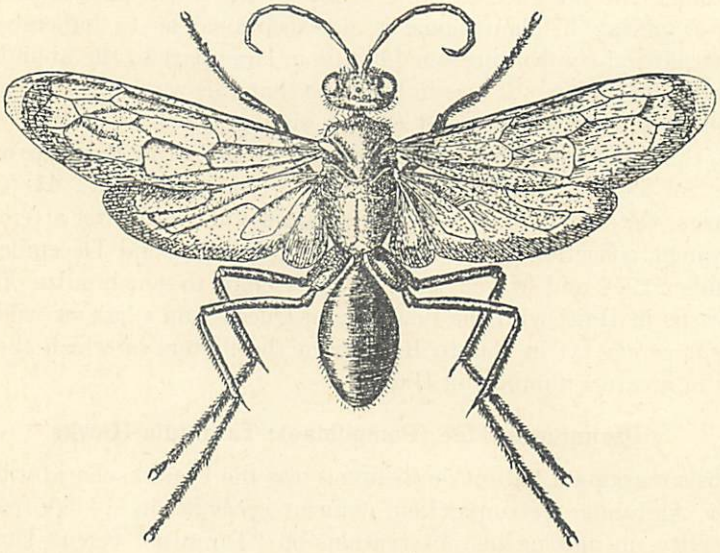
In late November and early December of 1946, collections of females of *Tiphia hispaniolae* Wolcott were made at Kenscoff and sent by airplane from Port-au-Prince to San Juan, some of which were released at Río Piedras or Isabela within less than 24 hours after collection in Haiti; the total mortality of the wasps en route being less than six per cent. In Hispaniola, the presence of white grubs in cultivated land, such as cane fields or pineapple plantations, is so exceptional as to indicate almost perfect natural control, presumably due in large part to the abundance of the endemic *Tiphia*. It was in the hope that this wasp might become established in Puerto Rico, and exert a similar effective control of white grubs, that its introduction was attempted. "Collecting Parasites of White Grubs for Puerto Rico: Then and Now" (Jour. Ec. Ent., **41** (5): 813. Menasha, October 1948) was indeed so successful at this first attempt that subsequent collections have been made in January and December 1947, December 1948 and March 1949, in an attempt to synchronize obtaining the wasps in Haiti with the flowering of Queen Ann's lace or wild carrot (*Daucus carota* L.) in Puerto Rico, from the flowers of which they were taken in greatest numbers in Haiti.

Psammocharidae (Pompilidae): Tarantula-Hawks

Pepsis marginata Palisot de Beauvois was the Psammocharid wasp used by Dr. Alexander Petrunkevitch, eminent specialist in spiders from Yale University, in making his observations on "Tarantula versus Tarantula-Hawk: a Study in Instinct" (Jour. Expt. Zool., **45** (2): 367–93, pl. 2. July 5, 1926) while exchange professor at the University of Puerto Rico. The hairy spider serving as host was *Cyrtopholis portoricae* Chambers. The wasp is the largest of the tarantula hawks occurring in Puerto Rico, but not the most brilliant, its legs and body being velvety black, its abdomen black with blue reflections in certain lights, its orange-yellow wings, except in front being duskily margined. The antennae of the males are curled; those of the females merely slightly curved. Listed by Dr. Stahl under this name, it is possible that this is what Drs. Gundlach, Dewitz and Ashmead call *Pepsis heros* Dahlbom, the former noting it as "común, pero aún no observado en Cuba." It is present in all the more humid parts of Puerto Rico, recent collections having been made at Luquillo, Río Piedras and Mayagüez.

Pepsis formosa Say, listed by Dr. Gundlach as *Pepsis caerulia* L. in

synonymy with *P. speciosa* F., as "rara en Puerto Rico," and by Drs. Dewitz and Ashmead, of which specimens from Puerto Rico were subsequently identified by Mr. S. A. Rohwer as *Pepsis rubra* (Drury) and confirmed under this name by Prof. Nathan Banks, is, according to Dr. E. O. Essig (1926–883) "the commonest and largest species in Mexico, Texas, New Mexico, Arizona and Southern California, and ranges south into Brasil." In Puerto Rico it was found both by Dr. Alex. Wetmore and Dr. Stuart T. Danforth to have been eaten by the kingbird. The females are much larger than the males, having bright orange-red wings very narrowly duskily margined, while the wings of the males are entirely blue-



The Tarantula-Hawk *Pepsis formosa* Say, twice natural size. (Drawn by Fritz Maximilien.)

black except for a small and rather obscure orange patch on the front margin of the forewings. They are so different in appearance, indeed, that the males have received the name of *Pepsis sanguigutta* Cresson, according to Prof. Nathan Banks. Both sexes have been observed associated on the same flowers obtaining nectar, specifically on the flowers of "cafeillo" (*Casearia sylvestris*) at Río Piedras on May 18, 1941, and again at about the same time the next spring, when the little tree was again in flower. Mr. D. L. Van Dine collected both sexes "flying among weeds over a sandy knoll along the sea-shore between a field of cane" and the Caribbean at Hda. Florida, Santa Isabel on April 24th, 1913. At Hda. Teresa, Aguirre on February 16th, 1916, males were noted in abundance on the sticky

capsule vine, *Commicarpus scandens*. Prof. J. A. Ramos found males very abundant on Caja de Muertos Island, off the coast near Ponce, and some females. Females quite often frequent the flowers of "botoncillo" (*Borreria verticillata*), having been recorded at Pt. Cangrejos and at Aguadilla, and collections have been made in cane fields, or in flight, at Yabucoa, Naguabo, Luquillo and Mayagüez. Judging by the size of the females it may be presumed that the normal host for the immature stages is the same large tarantula attacked by the less brilliant *Pepsis marginata*.

Pepsis ruficornis (F.), a considerably smaller, entirely blue-black wasp, except for bright orange-red antennae, listed by Drs. Gundlach, Stahl, Dewitz and Ashmead, has been repeatedly collected since in all parts of the Island, from cane fields on the coast to the highest mountains. It is possibly more abundant, and certainly more characteristic, however, of the higher elevations. Even in the depths of virgin forests, as at Maricao, and in abandoned coffee groves, as at Indiera, it is noticeable because of its nervously vibrating bright chestnut antennae, in constant motion as it explores the soggy ground in search of its prey. No observation has been made as to the species of spider which it may attack, but even the largest females seem much too small to tackle fully-grown tarantulas.

Cryptocheilus ignipennis (Cresson), of which *C. flammipennis* (Smith) is a synonym, is a small blue-black wasp with bright chestnut antennae, dusky at the apex. Dr. Gundlach notes it, with synonymy, as "rara," and it is listed also by Drs. Dewitz and Ashmead. If one may judge by recent collections at Luquillo, Río Piedras, Bayamón, Cayey, Florida and Utuado, it can hardly be considered rare at present. Prof. J. A. Ramos (1947–68) found it on Mona Island.

Notiochares cubensis Cresson, as determined by Prof. Nathan Banks, is as entirely black or blue-black wasp of equal size. Listed as a *Pompilus* with *Pompilus anceps* Cresson in synonymy by Drs. Gundlach, Stahl and Ashmead, it was subsequently determined by Mr. S. A. Rohwer as *Pompiloides propinquus* Fox. It occurs in all parts of Puerto Rico, and has been found on the flowers of *Heliotropium indicum* on the Island of Vieques. In a cane field at Coloso, a female was noted carrying a legless spider, unidentified as to species.

Dr. Gundlach notes as "rara" the **Pompilus cressoni** described from Puerto Rico by Dr. Hermann Dewitz (1881-203), and also lists **P. coruscus** Smith, **P. flavus** Cresson, and **Pompilus ferrugineus** Dahlbom, none of which has since been found in Puerto Rico.

What Dr. Gundlach collected at Quebradillas and lists under the name *Pompilus fulgidus* Cresson, has been re-determined by Prof. Nathan Banks from fresh specimens collected from the Mayagüez region as an **Anoplius.**

Of the other wasps listed by Dr. Gundlach under the genus *Pompilus*,

the "rara" **flavopictus** Smith, and the **mundus** Cresson (= *concinnus* Cresson) are now considered to belong to the genus **Batazonus.**

Batazonus hookeri, described by Mr. S. A. Rohwer (1915–237) from from specimens collected at Mayagüez, has since been found at Ponce, and on flowers of coriander at Isabela seed farm.

Batazonus mundiformis Rohwer, as determined by Miss Grace Sandhouse, was intercepted on *Commelina* at Pueblo Viejo, and another wasp intercepted at Loíza Aldea was identified by her as a species of **Episyron.**

Pseudagenia bella (Cresson), a small black wasp with clear wings, has been reared from mud nests in the leaves of *Inga vera* at Cayey. Presumably they had been provisioned with spiders, as Dr. Donald De Leon observed a female chasing spiders among the leaves of a mahogany tree at Villalba. Dr. Gundlach collected this wasp at Mayagüez, and it is listed by Drs. Dewitz and Ashmead as a *Pompilus*, latter collections having been made at Mayagüez by Mr. R. H. Van Zwaluwenburg.

Eumenidae

The enlarged pedicel of the abdomen of **Zethus rufinodus** (Latreille) is bright chestnut red, as are also the legs, but the apex of the pedicel is yellow, as are markings on the thorax; the head and gaster are black. Dr. Gundlach thought this wasp rare in Puerto Rico, and it may have been at the time when he was here, but it was found at Mayagüez by Mr. R. H. Van Zwaluwenburg, and since collected on mango blossoms there, and on the flowers of *Borreria verticillata* at Joyuda beach. It is common all along the north coast, frequenting flowers of both kinds of botoncillo, and has been noted even in the mountains, at Lares and at Adjuntas. It is very abundant on Mona Island, specifically noted on flowers of *Lantana camara* and on tender leaves of *Coccoloba laurifolia.* At Laguna Tortuguero, a fence post of West Indian birch or "almácigo" (*Bursera simaruba*) was so heavily infested by these wood-boring wasps that constant replacement was necessary. One almácigo post, alive and with buds starting from lower down, was attacked by the wasps, which made so many and such deep longitudinal tunnels in the exposed upper end that it no longer served to hold the staple, being merely a thin shell of birch bark over a crumbling mass of much tunneled wood and the immature stages of the wasp. No mud is used with which to line the tunnels. From the character of the debris, no indication as to the food of the larvae could be surmised.

Eumenes ornatus Saussure, of which recent determinations have been made as "var. *abdominalis* Drury," and as "*Eumenes abdominalis* Drury, var. *ornatus* Saussure," is listed by Dr. Gundlach as "rara," but collections were made by Dr. Stahl, and by Mr. R. H. Van Zwaluwenburg at Mayagüez. The present College (AMC) collection contains several dozen speci-

mens, mostly from the western end of the Island. This mud potter wasp, occurs, however, in all parts of Puerto Rico, the most humid and elevated as well the most xerophytic. Collections have been made on botoncillo flowers at Río Piedras, Loíza, Luquillo and Yabucoa, and presumably it also frequents other kinds of flowers The conspicuous apically expanded portion of the pedicel of the almost inch-long adult is possibly brightest yellow, but most of the gaster, all of the pronotum, the tegulae, scutellum, metanotum, the lower part of the face, and tibiae and tarsi are also yellow, or duller orange. At Isabela, its flattened spherical nests of mud were built on the needles of a casuarina tree to serve as provisions for the larva of the wasp, so beautifully fashioned with a flaring neck that one hesitated in breaking them open to determine with what they were stored.

Pachodynerus atratus (Fabricius), a plump, entirely black wasp with very dark wings, was listed by Drs. Gundlach and Dewitz as a *Rhynchium*. by Dr. Stahl as *Odynerus aethiops* Cresson MS, and more recent records are as a *Monobiella*. It commonly frequents the flowers of *Hyptis atrorubens* and of *Borreria verticillata* along the north coast, but also occurs in the mountains and on the south coast. Females have been observed entering the almost completed nest of the mud-dauber, *Sceliphron caementarium* (Drury), at Loíza, and on the rock cliff between Arecibo and Utuado, presumably indicating that it is parasitic on this species.

Pachodynerus nasidens (Latreille) has the tegulae and posterior margins of the pronotum and the segments of the abdomen dull yellow, wings lighter and yellowish, and a yellowish pubescence. Adults have been noted frequenting botoncillo flowers from Yabucoa to Isabela, and were intercepted on flowers of "roble" (*Tabebuia pallida*) at Bayamón and Vega Alta.

Pachodynerus tibialis (Saussure), not found in Puerto Rico, but on Mona Island, has bright yellow anterior margin of pronotum, tegulae, metanotum, posterior margins of two abdominal segments and most of the area of the tibiae. Mr. E. G. Smyth in 1913 made the earlier collections on Mona, and also in the following year accompanying the scientists from the American Museum of Natural History, but left no notes accompanying his specimens. Dr. Luis F. Martorell found the wasps abundant on the flowers of *Lantana camara* and of *Colubrina ferruginosa*.

Of **Odynerus bucuensis** Saussure, Dr. Gundlach reports: "He recibido esta especie últimamente del Dr. Stahl."

Ancistrocerus dejectus (Cresson) is a small, slender wasp, marked in dull red much as is *Pachodynerus tibialis* in bright yellow, and more deeply punctured. It was listed as an *Odynerus* by Drs. Gundlach, Stahl, Dewitz and Ashmead, and as a species of this genus is reported by Dr. Wetmore as eaten by the petchary, and by Dr. Danforth as eaten by the kingbird. Abundant at Mayagüez, elsewhere this wasp is not very common, the only

recent collections having been made at Loíza, Caguas, La Plata, Coamo, Maricao and Isabela. A large cluster of these wasps observed on an asparagus fern at Río Piedras, June 4, 1923, indicates that at times they may be quite numerous.

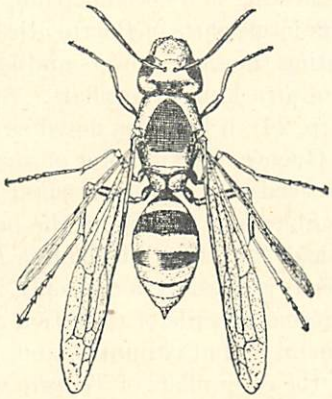
Monobia puertoricensis, described by Dr. J. C. Bequaert (Memorias de la Sociedad Cubana de Historia Natural, **15** (4): 375–8, fig. 1. Habana, Dec. 31, 1941) from a type collected by Dr. Luis F. Martorell at Cayey on the ground gathering clay, is a "medium-sized, slender species, 14 mm., fore wing 15.5 mm., ferruginous, slightly violaceous. Propodeum with teeth-like lateral angles, coarse transverse striation. Puncturation weak, except on clypeus."

Rygchium sp. is the determination by Dr. H. K. Townes of a single male wasp which Prof. J. A. Ramos (1947–68) collected on Mona Island.

Vespidae: Paper-nest Wasps

Polistes americanus Fabricius, the name given by Drs. Gundlach, Stahl, Dewitz and Ashmead for the common paper-nest building wasp of Puerto Rico, is again being used instead of *Polistes crinitus* Felton, as it was identified in 1913 by Mr. S. A. Rohwer. It occurs in all parts of Puerto Rico, and adults have been collected from the flowers of *Heliotropium indicum* on Vieques Island. On Mona Island adults have been noted on the tender leaves of *Coccoloba laurifolia*, and building nests, according to the observations of Dr. Luis F. Martorell, in mahogany and beefwood trees, as well as in seagrape and other endemic trees. The wasps frequent many flowers, having been noted on those of botoncillo at all localities, and more especially on those of the sticky-capsule vine, *Commicarpus scandens* L., at Guánica (May 1934), where they were more abundant than honey-bees, constituting 70 or 80% of all large Hymenoptera coming to these flowers. They are frequent visitors to partly-grown corn plants, collecting sap at punctures deserted by sucking insects, or stimulating its flow by biting the tissue, and also at times, as noted by Mr. W. K. Bailey (Mayagüez Station Report 1938–101) attacking and killing fat, juicy caterpillars of *Laphygma frugiperda* (A. & S.). On three separate occasions, they have been noted in cane fields attacking caterpillars of the Hesperiid, *Panoquina* (*Prenes*) *nero* F., and doubtless other kinds of caterpillars are eaten. One might hesitate about their status in the control of outbreaks of caterpillars, but at least they are a minor factor, and possibly in special cases may be of considerable importance. Enormous numbers of these wasps have been observed on El Yunque rock (April 5, 1939), so abundant that one could not even approach in safety. There appeared to be nothing in particular on the vegetation surrounding on which to feed: no caterpillars, no honeydew, and they kept in rapid motion, crawling and flying about on top of the

stunted trees and on the bare rock as tho in search of something that wasn't there. No nest was observed, and while the summit was dry at the time of observation it was not dry season for El Yunque, as heavy rains fell the day before and the day after. No other insect and no other species of *Polistes* was present. It is possible that air currents had carried these wasps up the mountain against their will, and continued to keep and concentrate them there despite their efforts to fly away. The wasps often show surprising persistence in building their paper nests in particular large, smooth-barked trees, such as ceibas, and specifically on the trunks and under the larger branches of jagüey trees in the Ciales-Mantí valley. A nest on such a frail support as molasses grass has been observed at Indiera. They often build on the concave sides of large rocks, or in roofless caves, and are an especial nuisance when determined to build under the eaves or porches of inhabited houses. Depending on the susceptibility of the



The Larger Paper-Nest Wasp, *Polistes major* Palisot de Beauvois, twice natural size. (Drawn by Fritz Maximilien.)

person and the part of the body attacked the sting of *Polistes americanus* varies from a temporary annoyance to a serious injury. Spraying with 5% DDT in kerosene will not kill the wasps in flight, or at least they succeed in flying away without apparent injury. But it does cause them to leave their nests, and they will not attempt to rebuild for several weeks, even in the most favored place if it has been drenched with DDT.

Dr. Wetmore found that the adults of *Polistes americanus* are eaten by the kingbird, petchary, flycatcher and wood pewee, and Dr. Danforth by the cliff swallow, and they have subsequently been found in the stomach remains of a judío shot at Florida. The wasp is not too active to escape capture by the crested lizard, nor by the Asilid fly, *Proctacanthus rufiventris* Macq., but a somewhat unexpected enemy is fungous disease. Wasps

stuck to the leaf of *Didymopanax morototoni* at Lares had been killed by a fungus identified by Miss Vera K. Charles as *Hirsutella saussurei* (Cke.) Speare. The fungus sticking another individual to a citrus leaf, collected by Mr. Felipe Mora at Lares, was identified by her as *Cordyceps spheco-cephala* (Kl.) B. & C. According to Mr. Karl V. Krombein, "the local form of this wasp should be called **Polistes crinitus americanus** (F.)."

Polistes major Palisot de Beauvois, as determined by Miss Grace Sandhouse, is considerably larger than the endemic *Polistes americanus*, being seven-eighths of an inch long. Presumably it is a new arrival, for, according to Dr. J. C. Bequaert (Entomological News, **47** (1): 7–13. Philadelphia, January 1936), the first record from Puerto Rico was of collection by Mr. Francisco Seín in September 1930 at Lares. It is supposed that the hurricane of 1928 brought this larger and more powerful species to Puerto Rico, and also to Mona Island, as Dr. Luis F. Martorell found it there in abundance (August 8, 1939), nesting in a coconut palm, and on seagrape and beefwood. It now occurs in all parts of Puerto Rico, but is not especially abundant, altho frequenting the same flowers and having the same habits as the endemic species of attacking caterpillars. Specifically (Mayagüez Station Report for 1939, p. 26), it has been noted as killing the caterpillars of *Terastia meticulosalis* Guenée, the tip-borer of bucare trees, near Mayagüez, where "it was observed that a wasp secured and devoured a borer by holding it in its mandibles and feeding on the body fluids."

Mischocyttarus phthisicus (Fabricius), listed as a *Polybia* by Drs. Gundlach, Dewitz and Ashmead, is possibly found only in the western end of Puerto Rico, as all the recent records of collection are: intercepted in an orange grove at Barceloneta, and at Adjuntas, and, as determined by Dr. K. A. Bartlett, attacking the caterpillars of *Terastia meticulosalis* Guenée at Mayagüez. As *Megacanthopus indeterminabilis* (Saussure) it is listed by Mr. R. H. Van Zwaluwenburg as P. R. 66. *Polybia mexicanus* Saussure, listed by Mr. Ashmead from Puerto Rico is also a synonym.

Mischocyttarus cubensis (Saussure), not mentioned by Dr. Gundlach, but listed as a *Polybia* by Drs. Stahl and Ashmead, and later identified as a *Megacanthopus* by Mr. S. A. Rohwer, is only three-eighths of an inch long. The expanded apex of the pedicel of its abdomen is bright yellow, and indeed its markings of yellow and orange exceed in extent those of black. It builds an irregular, brownish, papery nest of ten cells of usable size, and a few others much smaller. For the most part, it lives at the higher elevations, collections having been made on El Duque near Naguabo, and in the higher coffee groves of Cialitos. Dead specimens found near Lares were stuck to citrus leaves by a fungus identified by Miss Vera K. Charles as *Cordyceps sphecocephala* (Kl.) B. & C. It is possibly this species which Dr. Stuart T. Danforth found in the stomach contents of a kingbird.

= Mischocyttarus (Monocyttarus) mexicanus cubicola (de Saussure). See Hermann & Chao Florida Ent 67(4) 1984

The wasp may occur near sea-level, having been intercepted in grapefruit groves at Bayamón and Vega Alta, and Prof. J. A. Ramos (1947–68) found a nest "under a leaf of a tree at Sardinera Beach" on Mona Island.

APOIDEA (Bees): Halictidae (Sweat Bees)

Agapostemon portoricensis, described by Prof. T. D. A. Cockerell (Proc. U. S. National Museum, **55** (2264): 209. Washington, D. C., 1919) as a variety of *radiatus*, from two males collected by Mr. Aug. Busck at Mayagüez, January 1899, is a bee 9 mm. long, with bright green head and thorax, light yellowish legs, the abdomen brown above except for the yellow margins of the first four segments. This is what Drs. Gundlach and Stahl doubtfully list as *Agapostemon festivus* Cresson ("the male of *A. poeyi* Lucas" which has a bluish-green abdomen), or *A. tricolor* Lepeletier; to which, because of obvious differences, Cresson had given the MS name of *A. krugii*. A cluster of twenty or thirty of these bees was noted on a few grapefruit leaves at Manatí, June 7, 1916, but subsequent collections have been of single individuals, one having been found in three square feet of sandy pasture at Pt. Cangrejos, and others often noted on sandy beaches, frequenting flowers in the more humid sections of the Island. Its distribution is not limited, however, to such areas, for it has been collected at Yauco and Ponce, as well as in the mountains at Jájome Alto, and between Cayey and Salinas, and at Maricao, Villalba and Luquillo. Dr. Luis F. Martorell found it, as identified by Miss Grace Sandhouse, common on the flowers of *Lantana camara* at Sardinero and Playa de Pájaros, Mona Island.

Augochlora busckii, described by Prof. T. D. A. Cockerell (Proc. U. S. National Museum, **37:** 493. Washington, D. C., 1910), the type from Aguadilla, has since been found in grapefruit groves at Bayamón and Dorado, and also at Jájome Alto. It is an iridescent greenish-blue bee with black antennae, legs and wing veination. Presumably this is the *Augochlora parva* Cresson of Cuba which Drs. Gundlach, Dewitz, Stahl and Ashmead list from Puerto Rico, and of which Dr. Wetmore reports finding remains in the stomach contents of a kingbird.

Much smaller than the above are the little shining greenish-black bees of the genus *Halictus*, the remains of which Dr. Wetmore reports finding in the stomach contents of the wood pewee. They occur on El Yunque, on the beach at Luquillo and Mameyes, and on Mona Island, but no species identification was made of those from Mona. Presumably, however, this is *Halictus* **busckiellus** described by Prof. T. D. A. Cockerell (Ann. Mag. Nat. History, **16:** 9. London 1915) from specimens collected in Santo Domingo. It is also present in Puerto Rico, for Miss Grace Sandhouse thus

identified some intercepted on the flowers of *Bidens pilosa* at Bayamón, and Mr. Karl V. Krombein as **Lasioglossum (Chloralictus) busckiellus** (Cockerell) a male from La Plata and a female from Lajas, besides many from flowers of coriander at the Isabela seed farm in April 1948, and from flowers of Queen Ann's lace at Río Piedras in June 1948.

Halictus proangularis Ellis, described (Entomological News, **25** (4): 155. Philadelphia, 1914) with the type from Bayamón, has since been intercepted on milkweed flowers from the type locality and on crotalaria flowers at Arecibo. The length of the female is 6.5 mm., "head, thorax and abdomen rather dark, uniform greenish blue, abdomen more shiny," "the sharp tubercles and anterolateral angles of the prothorax" and "the uniform greenish blue color of the dark wings" being distinctive. The *Halictus poeyi* Lepeletier listed by Ashmead is presumably one of these.

Panurgus parvus Cresson is listed from Puerto Rico by Drs. Gundlach, Dewitz and Ashmead, but has not since been collected.

Euceridae

Melissodes trifasciata, described from Mayagüez, Puerto Rico by Mr. E. T. Cresson (Proc. Acad. Nat. Sciences, Philadelphia, 1878, p. 208), is a short, plump, hairy, medium-sized black digger-bee, three segments of the abdomen being transversely banded with yellow. The males have extremely long antennae, and, as identified by Mr. Karl V. Krombein, have been most recently found in abundance on the flowers of coriander, *Coriandrum sativum*, at the Isabela seed farm, in March 1948. It occurs in all parts of the Island, earlier collections or interceptions having been made at Parguera and Guayanilla, as well as at Orocovis, Barceloneta, Bayamón, Palo Seco and Río Piedras, frequenting the flowers of roble, crotalaria, sweet potato and "anamú" (*Petiveria alliacea*). This bee is listed by Drs. Gundlach and Stahl, and in addition, *Melissodes mimica* Cresson, not since collected in Puerto Rico.

Anthophoridae

Exomalopsis globosa (F.), a small shining black bee, has been repeatedly identified from Puerto Rico: by Mr. J. C. Crawford, Mr. S. A. Rohwer, Miss Grace Sandhouse, and most recently by Mr. K. V. Krombein, from flowers of coriander at Isabela. First observed by Mr. G. B. Merrill tunnelling in hard clay at Guánica, these bees occur in all parts of the Island: Yauco, Jayuya, Mayagüez, Guajataca Dam, Arecibo, Barceloneta, Florida, Tortuguero Lagoon, Río Piedras, Mameyes, Cayey, and La Plata; frequenting many kinds of flowers including both kinds of "botoncillo," mango and crotolaria and *Barbiera pinnata*. As no other species of this genus

has recently been found here it may be presumed that the *Exomalopsis pulchella* Cresson noted by Dr. Gundlach as "común," and *Exomalopsis similis* Cresson, also listed by him and by Drs. Dewitz, Stahl and Ashmead, are misidentifications for this one common species of black bee.

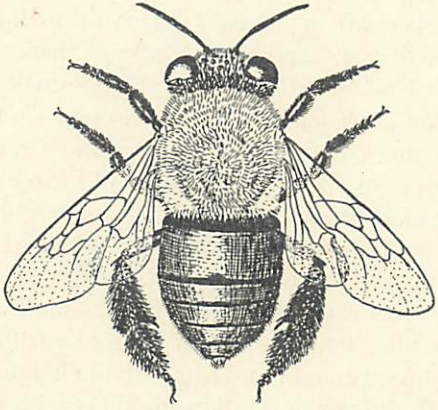
Anthophora krugii, described from Puerto Rican material by Mr. E. T. Cresson (Proc. Acad. Nat. Sciences, Philadelphia, 1878, p. 188), is a rather large plump black bee with the apical margin of all segments yellow, the fore part of the abdomen and the rear of the thorax coarsely pubescent with chestnut hairs, the face with silvery ones. Dr. Gundlach notes: "Mr. Cresson la consideró distinta de la *A. tricolor* F." and gives the MS name of *krugii*, while Dr. Stahl has the old name of *Magilla tricolor* for his specimens. Mr. Thos. H. Jones at Río Piedras observed a hundred or more of these bees "resting or flying about in weeds of 'artemisa cimarrona' (*Parthenium hysterophorus*) in bright sunlight at 1 PM, May 23, 1912, congregated in a small area," and caught forty of them with one sweep of the net. Mr. J. C. Crawford found that all were males. Females have been observed nesting in the clay banks of roadways: in Guajataca Gorge, and between Ciales and Villalba. On Mona Island Dr. Luis F. Martorell observed their burrows in the walls of the Viejo Lirio cave, Playa de Pájaros, in the spring of 1940, and also noted wasps frequenting the flowers of *Moringa oleifera* and *Colubrina ferruginosa*. At Río Piedras, they were noted frequenting tomato flowers by Dr. Richard T. Cotton, and on the edge of one of Aguirre's cane fields, Mr. D. L. Van Dine recorded their abundance on unspecified flowers. Despite their swift flight Dr. Wetmore found that they had been caught and eaten by the kingbird.

Hemisia lanipes (Fabricius), a medium-sized bee with chestnut abdomen and thorax densely covered with yellow pubescence, is normally not very common in Puerto Rico. Dr. Gundlach had specimens from Mayagüez, and Dr. Stahl records it as *Centris fulviventris* Cresson and *Centris dentipes* Smyth, not in synonymy. Individual wasps have since been taken at Río Piedras, Bayamón and Salinas. On Mona Island, Dr. Luis F. Martorell in August 1939 collected but a single specimen on Sardinera Beach, but on the same beach on March 31, 1940 he found them very abundant, frequenting the flowers of *Moringa oleifera* during the early sunny hours of the morning, and again late in the afternoon, but not at midday.

Hemisia haemorrhoidalis (Fabricius), a considerably plumper bee, densely pubescent with black hair on the head, thorax and fore part of the blue-black abdomen, has reddish hair on its apex. The male, as identified by Mr. Karl V. Krombein, has subtriangular dull yellow spots laterally on the second segment of the abdomen. Noted by Drs. Gundlach and Dewitz, and in Van Zwaluwenburg's list, it has since been found mostly

in the western end of the Island, at Peñuelas, Boquerón, Mayagüez, Aguada, Aguadilla, Lares and Barceloneta, with a single collection from Luquillo. Adults were abundant nesting in a clay bank at Guajataca, and in that region have been noted frequenting flowers of botoncillo and beans. In the spring of 1940 on Mona Island, Dr. Luis F. Martorell found them on flowers of *Moringa oleifera* and *Pisonia albida* on Sardinera beach and also on the plateau.

Hemisia versicolor (Fabricius), the largest of the Anthophorid bees occurring in Puerto Rico, black with thorax and hind tibiae densely pubescent with long, dull orange-yellow hair, is noted by Dr. Gundlach as "común," listed by Drs. Stahl, Dewitz and Ashmead, and (misidenified as *Centris decolorata* Lepeletier) in Van Zwaluwenburg's list. The males, with elongate



The largest Anthophorid Bee in Puerto Rico, *Hemisia versicolor* (Fabricius), three times natural size. (Drawn by Fritz Maximilien.)

dull yellowish triangular bands laterally on the second segment of the abdomen, have been seen in late summer on sandy beaches at Humacao, Dorado, Arecibo and Mayagüez, flying low over weeds, but obviously not interested in flowers. Now and then some alight momentarily on the sandy ground, and promptly take flight again. Among them are a very few females. On Mona Island, in August 1939, Dr. Luis F. Martorell found both sexes on the flowers of *Lantana camara* and in much greater numbers the following spring on the flowers of *Moringa oleifera, Colubrina ferruginosa* and *Pisona albida*. Dr. Wetmore found this bee to have been eaten by the kingbird.

Megachilidae: Leaf-cutting Bees

Coelioxys abdominalis Guérin-Méneville, a social parasite in the nests of other species of Megachilid bees, has a flattened triangular chestnut ab-

domen, black head and thorax, with dense bright yellow pubescence around the margins. It has most often been collected at Mayagüez (Gundlach, Van Zwaluwenburg and Danforth), but occurs in at least all the more humid parts of the Island, with records from Utuado, Guajataca, Bayamón and Río Piedras.

Megachile (Archimegachile) lanata (Fabricius), of which *Megachile vitrasi* Perez and *M. martindalei* Fox are synonyms according to Dr. T. B. Mitchell, is an African leaf-cutting bee which has been introduced into many islands of the West Indies. It is black with dark orange pubescence on the head, thorax and first two segments of the abdomen, becoming black on the apical three, which are sharply margined with white, and more obscurely, the two basal segments. It has been noted building nests of mud under the eaves of a house at Río Piedras, and also taking advantage of hollow bamboo stems to construct nests with a minimum amount of mud. The females visit flowers, having been observed frequenting those of bean at Río Piedras, of sweet-potato at Mayagüez and of crotalaria at Barceloneta, but without record of host intercepted in citrus groves at Trujillo Alto, Dorado and Barceloneta. More rarely, they have been noted frequenting the flowers of "botoncillo" (*Borreria verticillata*), at Yabucoa and along the north coast to Isabela.

Megachile insularis Cresson, as determined by Mr. Karl V. Krombein, and previously listed by Ashmead, is a considerably smaller species, lacking the dark orange pubescence, of which specimens have been collected by Dr. Stuart T. Danforth at Río Piedras and San Germán.

Megachile (Eutricharaea) concinna Smith, as determined by Miss Grace Sandhouse is a similar small bee, collected on flowers at Salinas, and by Prof. J. A. Ramos at Mayagüez, Santurce and Río Piedras.

Dr. T. B. Mitchell identifies the large but similar leaf-cutting bee from Mona Island and the more xerophytic areas of southwestern Puerto Rico as being an undescribed species of **Megachile**. Mr. E. G. Smyth made the first collection on Mona Island in 1913, but twenty-six years later Dr. Luis F. Martorell noted the terrible noise these bees made in the Viejo Lirio cave at Playa de Pájaros, looking for holes in the walls of the cave. The following spring he noted their abundance on the flowers of *Moringa oleifera* and *Pisonia albida*. Prof. J. A. Ramos collected them on the flowers of wild indigo at Faro de Cabo Rojo, and they have been intercepted at Guánica and Parguera. They are mostly black in color, with marginal yellow pubescence, each segment of the subtriangular abdomen being sharply margined with yellow.

Megachile poeyi Guérin-Méneville and *Megachile singularis* Cresson are the Cuban species of leaf-cutting bees listed from Puerto Rico by Drs.

Gundlach, Stahl, Dewitz and Ashmead, but, judging by the absence of more recent records, actually not present here.

Nomadidae: Cuckoo Bees

Nomada krugii, the endemic cuckoo bee which Mr. E. T. Cresson (Trans. Amer. Ent. Soc., **7:** 75. Philadelphia, 1878) described from the Puerto Rican specimens supplied by Dr. Gundlach, was listed as *Nomada cubensis* Cresson by Drs. Gundlach, Dewitz and Ashmead. It has not since been found.

Hypochrotaenia pilipes, originally described as a *Pasites* from Cuban specimens by Mr. E. T. Cresson (1865–183) as "chestnut-brown, polished; sides of face, clypeus, collar, tubercles, two spots on pleura, postscutellum and narrow costo-apical margin fuscous," is listed from Puerto Rico by Drs. Gundlach, Dewitz and Ashmead. Interceptions have been made on flowers of *Barbiera pinnata* at Barceloneta, of mango at Mayagüez, on pepper at Guaynabo, and at Loíza and Ponce, and most recent collection made on flowers of coriander at Isabela.

Melectidae

Melecta (Nesomelecta) pantalon, originally described as a *Crocisa* by Dr. H. Dewitz (1881–198) from the type collected in Puerto Rico by Dr. Gundlach, is the identification by Mr. Karl V. Krombein of a bee found by Mr. Francisco Seín at Lares, attached by its jaws to a dry twig, its body horizontal with the ventral side up. It is a blue-black bee, 13.0 mm. long, with dense silvery pubescence on head and thorax, very dense tufts of white hair on the sides of the anterior segments of the abdomen, and chestnut-colored legs.

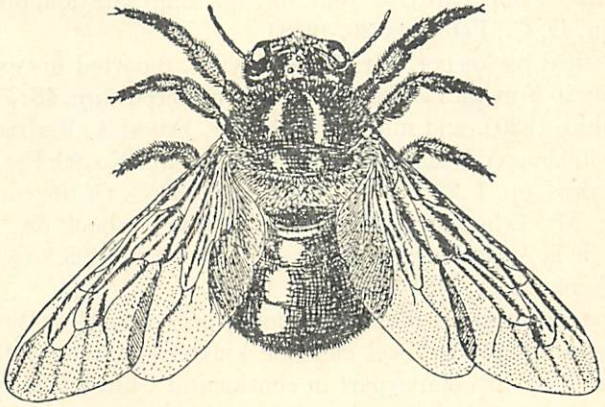
Mesonychium sp. is the identification by Mr. Karl V. Krombein of a slender black bee, 9.0 mm. long, with silvery pubescence, very short on the abdomen, and almost invisible in some lights, forming broad bands dorsally on the first three segments except along the median line. Mr. Francisco Seín collected one of these bees at Lares resting on grass, and unlabeled specimens are in the College collection at Mayagüez.

Melissa rufipes Perty is a name listed by Dr. Stahl.

Xylocopidae: Carpenter Bees

Xylocopa brasilianorum (Linnaeus), the only species of carpenter bee in Puerto Rico, was listed earlier as *X. morio* (Fabr.), of which Dr. Gundlach wrote: "Es notable por la diferencia de colorido entre el macho y la hembra (males are yellow, females black). Las larvas viven dentro de la madera en divisiones separadas en un tubo común, una encima de otra." These enormous bees, not as large as *Campsomeris atrata* but so broad as

to make them the largest Hymenopteron in Puerto Rico, occur in all parts of the Island, and possibly because more dead branches, undisturbed by man, are available for their tunnels on Mona Island, are especially abundant there. The males are comparatively rare. One came out of this tunnel in a dead branch of hibiscus not more than twice the diameter of the tunnel itself, very angry at being disturbed, September 1942 at Rio Piedras. The entrance was in the middle of the tunnel, which was about nine inches long, in many places lined, or dusty, with pollen. From a larger tunnel in a dead branch of mahogany tree, June 1940 at Hda. Algarrobo, Guayama, Dr. Luis F. Martorell saw eight adults emerge, and found that it contained two larvae and two adults. Prof. J. A. Ramos saw several males and several females emerge from a nest in an old branch of *Ficus stahlii* on Mona Island.



The Carpenter Bee, *Xylocopa brasilianorum* (L.), female. Twice natural size (Drawn by F. Maximilien.)

The bees are not fussy about the kind of wood in which their burrows are made, and records of fence-posts attacked, of several kinds of wood, are possibly most numerous. Old, deserted tunnels may serve as shelter for small lizards: a natural but somewhat unexpected case of a large insect making a shelter large enough for occupancy by a vertebrate animal. The female bees frequent many kinds of flowers, especially hibiscus, scaring away any butterfly or other bee or wasp that might be sucking nectar there first.

Apidae: Honey Bees

Apis mellifera Linnaeus, the domestic honey bee, had long been present in Puerto Rico at the time that Dr. Gundlach wrote: "Esta especie (*Apis mellifica* L.) fué introducida de Europa y existe ahora, no solamente en los colmenares, sino también cimarrona en árboles huecos de los montes

y en las grietas de las peñas." Mr. Aug. Busck, who visited the Island in 1899, noted that "very large colonites of a dark variety of *Apis mellifica* were abundant in hollow trees and especially in caves, sometimes also in outhouses. These are annually smoked out and furnish large quantities of honey." Mr. W. V. Tower was much interested in commercial "Bee Keeping in Porto Rico" (Circ. No. 13, P. R. Agr. Expt. Station, pp. 1–13, fig. 1. Mayagüez, 1913), and Dr. E. F. Phillips visited the Island to report on "Porto Rican Bee Keeping (Bull. No. 15, P. R. Agr. Expt. Station, pp. 1–24, pl. 2. Washington, D. C., May 29, 1914). Practical work on "Some Needs of the Porto Rican Beekeeper" by Mr. Rafael Vidal (Gleanings in Beeculture, **44:** 409–10, fig. 1. Medina, Ohio, 1916) eventually led to experiments in "Rearing Queen Bees in Porto Rico" by R. H. Van Zwaluwenburg & Rafael Vidal (Circ. No. 16, P. R. Agr. Expt. Station, pp. 1–12, fig. 5. Washington, D. C., February 26, 1918).

The practical beekeeper, Mr. P. G. Snyder, reported his experiences of "Beekeeping in Foreign Lands" (Gleanings in Beeculture, **48:** 721–24, fig. 3. Medina, Ohio, 1920), and most recently Mr. David A. Rodríguez has discussed "Problemas Apicolas de Puerto Rico" (Circ. No. 99, Est. Expt. Insular, Río Piedras, pp. 1–22, fig. 4. San Juan, 1932). Of the early history of beekeeping, Mr. Edmundo Colón has written in his book on "Datos sobre la Historia de la Agricultura de Puerto Rico antes de 1898," (pp. viii & 302. Cantero, Fernandez y Cía., San Juan, 1930).

On the natural enemies of domestic honey bees, Dr. Alex. Wetmore noted their being eaten by the local endemic kingbird in Puerto Rico, just as they are eaten by its counterpart in continental United States. More recent examination of the stomachs of the "pitirre," shot near Laguna San José, Sabana Llana in January 1935, showed that a maximum of 15 and a minimum of 3 individual honey bees formed from 100% to 30% of the stomach contents of these birds, five of them having eaten nothing else. Mr. H. Bourne, the Barbadian cane technologist employed by Guánica Centrale, told of how the specimens of *Bufo marinus* sent to Mr. D. W. May, Director of the Mayagüez Station, were collected in Barbados, from around a hive of bees. Naturally, their descendents in Puerto Rico might also be expected to eat bees, given the opportunity, unless the hives were placed well off the ground and had a shelf in front of the entrance, where the laden bees could rest on their return. In extreme cases hives may have to be fenced in with tight chicken-wire to keep the toads away. The little yellow grass lizard, *Anolis pulchellus*, also eats bees. Despite all these natural enemies, however, the number of honey bees observed on any aggregation of flowers is the yardstick by which one judges the comparative abundance of other flower-frequenting insects. It proved especially useful when determining the abundance of the introduced changa parasite, *Larra*

americana, on botoncillo flowers. Dr. Phillips had noted the importance of these flowers in the secretion of nectar for the domestic honey bees, and intensive observations on the flowers of *Hyptis atrorubens* and *Borreria verticillata* show how much these unobtrusive plants furnish.

Surprisingly enough, the investigations of Mr. Francisco Seín on "Las Abejas en los Cafetales" (Circ. No. 79, Est. Expt. Insular, Río Piedras, pp. 1–6, fig. 1. San Juan, November 1923) indicated that insects are not necessary for the setting of the coffee crop, the flowers being self-fertile or wind-pollinated even when thrips and ants are excluded from them. Some coffee growers had seen honey bees knock the petals off the withering coffee flowers, and claimed that they were knocking off the young berries before they had set: a hasty observation, not supported by the facts as to the injury that honey bees might cause. But Mr. Seín's experience showed that, except for the beekeeper, no benefits were obtained by an abundance of either domestic or wild bees in groves. Indeed, unless the bees also belonged to him, the presence of the domestic bees was neutral so far as the coffee grower was concerned.

ACKNOWLEDGMENTS

The very close friendship, both personal as well as official, between Dr. L. O. Howard, Chief of the Bureau of Entomology, USDA, Washington, D. C., and Mr. D. L. Van Dine, Entomologist (1910–1914) of the Sugar Producers' Experiment Station at Río Piedras, resulted in all the facilities of the Bureau and of the U. S. National Museum being made available by Dr. Howard for the prompt identification of whatever insects might be collected in Puerto Rico. The transfer of the Station to the control of the Insular Government (coming under the direction of the Department of Agriculture and Labor, or the Department of Agriculture and Commerce, and later of the University of Puerto Rico), and the departure of Mr. Van Dine did not break the continuity of this co-operation, to the inestimable benefit of his successors. Indeed, changes in organization at Washington have only sometimes resulted in direct communication with the specialist making the determinations, or, more often, with Dr. Harold Morrison, and later Mr. C. F. W. Muesebeck, in Charge of Insect Identification at the National Museum. This has been of the greatest value to the entomologists at Río Piedras, and it is upon the cumulative identifications thus obtained that the nomenclatorial frame for the present publication and previous annotated lists has been built. To all the specialists, from the earliest years to the present, at Washington, and also at New York, Cambridge, London, and sometimes elsewhere, and most especially to Mr. Muesebeck who had prepared a photostatic copy of Moritz' paper and has been unwearying in answering questions and clearing up disputed points, the writer is most sincerely grateful. To them should go the credit, the errors and the mistakes are mine.

Mr. Curtis W. Sabrosky, Dr. Alan Stone and Dr. Willis W. Wirth, examining the section in the Diptera in which they were particularly interested when it had already entered the stage of page proof; Messrs. J. G. Franclemont, J. F. Gates Clarke and Hahn W. Capps for the Lepidoptera; and Mr. C. F. W. Muesebeck, Mr. A. B. Gahan, Dr. M. R. Smith and Mr. K. v. Krombein for the Hymenoptera, may not be especially happy (nor is the writer) at the necessity of fitting their last minute suggested changes into the available space. Those considered essential now by Dr. T. E. Snyder for the Isoptera, Dr. A. B. Gurney for the Orthoptera, and Dr. E. A. Chapin in the Coleoptera, who examined sections in the original MS several years ago, and by Dr. J. D. Hood in the Thysanoptera, can only be given here as addenda.

The accumulation of biological data to hang on the nomenclatorial frame was largely automatic after having been initiated by Mr. Van Dine

in the accession catalog of the Station. To his wisdom in starting such a system and to the unfailing and most obviously meticulous care with which it was expanded by Mr. Thos. H. Jones, few subsequent workers have failed to respond by adding their quota. Previous annotated lists have given the data as recorded, and it is hoped that no significant contribution has failed of due credit in the present publication.

Dr. Robert Morss Lovett, of the English Department of the University of Chicago, giving a course in "Creative Writing" at the University of Puerto Rico, read all the MS or page proof, ironing out roughnesses and obscurities, and suggesting the omission of numerous commas, some of which the writer still thinks should have remained. Dr. Lovett should not, however, be held responsible for any infelicity in the English of the final publication, for numerous changes were made after his departure, and the writer can only record gratitude for his improvement of the parts of the original MS that actually passed under his inspection.

During a summer vacation from Swarthmore, my son, Oliver Wolcott, prepared a subject index from galley proof that proved of inestimable value in the insertion of the page references when final page proof was available.

To the numerous young ladies (their specific identity often already lost in the constantly changing stenographic personnél of the Station) who copied larger or smaller sections of the MS, the writer is most grateful for the drudgery from which he was saved. Whether it was a real saving in time may be questioned, for each girl had a different system of making errors. Too late to be used for most of the original MS, Mrs. Lucy Fránqui de Santiago, now appointed for the exclusive use of the Division of Entomology, is a pearl without price, for she copies exactly, including, alas, all the errors of the writer which her inexperience in scientific writing has not detected in the MS and called to his attention.

The Editor of the Station publications, Mr. E. Molinary Salés, is to be thanked for reading the final proof, checking especially the local personnél and locality records, and words, phrases and quotations in Spanish.

ADDENDA et CORRIGENDA

On the title page of No. 1, read ISOPTERA instead of ISPOTERA.

On page 30: The red spider first noted by Mr. Ferdinand Méndez injuring the appearance of the underside of the leaves of orchids has been determined by Dr. Edward W. Baker to be his *Tenuipalpus pacificus*, of the family Phytoptipalpidae (= Pseudoleptidae): "a serious pest to orchids in California."

On page 45, add to the second paragraph: Dr. John W. H. Rehn has recently shown that Puerto Rico has two distinctive species of "The Genus **Aspiduchus**" (Noctulae Naturae 231, pp. 7, pl. 1. Philadelphia, Feb. 14, 1951), describing that collected by Mr. Crampton in the caves at Corozal as **borinquen**, and that collected by Prof. J. A. Ramos and Mr. J. Maldonado Capriles in caves at Cabo Rojo as **cavernicola.**

"The drawing on page 49," as is noted by Dr. A. B. Gurney in a letter of March 19, 1951, and as he showed the writer in Washington a few days later, comparing drawings in literature, "may be the species indicated, as I wrote you in 1947 was probably the case. A further comparison with the illustrations of Westwood and Saussure leaves some doubt that either *ceratocephalum*, or the supposedly synonymous *adumbratus*, is involved," and indeed it "resembles fairly well some species of *Antillophilus*." The description by Rehn & Hebard of **Antillophius restrictus** Redtenbacher checks closely with the more obvious characters shown in the drawing and in other specimens from El Yunque, and presumably is the correct name.

The small, winged, green or brown walkingsticks found by Dr. Luis F. Martorell, September 26, 1950, feeding on the leaves of "jácana," *Lucuma multiflora* A. DC., at El Collao, the highest point in the pass between Cayey and Salinas, tentatively identified by Dr. Gurney as *Aplopus jamaicensis* (Drury), actually differ in details from the illustration of this species, and can only be recorded as of the genus **Aplopus.**

On page 58, after fourth paragraph, add:

Cycloptilum antillarum Redtenbach, noted by Dr. Gundlach as *Liphoplus krugii* Saussure, "de los contornos de Mayagüez," has not since been taken there, altho "numerous specimens were swept from vegetation on Sardinero and Uvero Beaches" on Mona Island by Prof. J. A. Ramos (1947-10), and it has been intercepted in a maga tree at Arecibo, and at San Juan.

Dr. Thomas E. Snyder's "Catalog of the Termites (Isoptera) of the World" (Smithsonian Misc. Collections, Vol. **112,** pp. 490, Washington, D. C., November 1, 1949), published at the same time as No. 1 of "The Insects of Puerto Rico," requires certain changes in the nomenclature of the termites discussed in the latter. As noted by Dr. Snyder in his letter of January 10, 1951, these are:

"p. 62: Emerson and I for the present are placing **mona** in the genus **Kalotermes;** there are *Neotermes* characters, however, the genera need further study and revision; there are overlapping characters in these former subgenera.

"p. 63: **cavifrons** is a **Cryptotermes."**

the legend under the illustration on p. 64 should read *Kalotermes,* not *Kalotenmes.*

"p. 68: **corniceps** is now placed in the genus **Procryptotermes.**

"p. 69: *Eutermes theobromae* is an African species from St. Thomas; it is a valid species, not a synonym of **arboreus.**

"p. 73: *Nasutitermes creolina* soldiers from Puerto Rico are **Nasutitermes nigriceps** (Haldeman); the winged from Montserrat *ephratae."*

Dr. J. D. Hood notes (page 94) that *Gynaikothrips uzei* Zimmerman is not a synonym for **Gynaikothrips ficorum** Marchal, all records of infestation on *Ficus nitida* referring to the latter species. The former is presumably restricted to *Ficus benjamina* as host, not observed infested in Puerto Rico.

Dr. Hood states that *Diceratothrips wolcotti* Morgan (page 95) is a synonym of **Diceratothrips picticornis** Hood, and doubts the occurrence of his *Ommatiothrips gossypii* in Puerto Rico. **Aleurodothrips fasciapennis** Franklin was not originally described in that genus, nor **Hoplandothrips reynei** Priesner, nor **Franklinothrips vespiformis** Crawford.

Dr. Dozier's record of *Liophloeothrips portoricensis* Watson MS may possibly refer to a **Karynothrips,** to which genus *Haplothrips* **merrilli** Watson is now assigned.

Mr. H. J. Franklin originally described **Haplothrips gowdeyi** (page 96) as *Anthothrips.* Dr. Hood's *Haplothrips* **tibialis** is now assigned to the genus **Adraenothrips.** "**Chaetanaphothrips orchidii** (Moulton) is not an *Anaphothrips."*

On the first line of page 97, read **melaleucus** for **melalencus,** and on the fifth line, **Limothrips** for **Limnothrips,** this not being the genus in which Mr. A. H. Haliday originally described the species **cerealium.** On page 98, *Thrips abdominalis* is now **Microcephalothrips abdominalis** (Crawford). **Thrips tabaci** (page 99) was originally described by Mr. K. Lindeman, not Lindemann. The presently accepted name for the continental bean thrips, (second paragraph, page 101) is **Caliothrips fasciatus** (Pergande).

On page 106, after fifth paragraph, add:

The publication by Drs. John S. Caldwell and Luis F. Martorell of their paper on "Cicadellidae" (Jour. Agr. Univ. P. R., 34 (1—January 1950): *in press*) renders the following account, written before the trip of Dr. Caldwell to Puerto Rico to collect leafhoppers was even contemplated, and in galley proof while collections were still being made, largely obsolete. Before their publication has appeared, however, Mr. Julio Bird has collected nymphs and adults of an **Empoasca** on pumpkin at Corozal, which will feed on papaya, considered by Dr. David A. Young, Jr., of the U. S. National Museum, to be a new species.

On page 134, second paragraph, read **Megamelanus** for **Megamelus.**

On page 141, after sixth paragraph, add:

Neomalaxa flava, described by Mr. F. Muir (1918-426) from Mayagüez, P. R., and listed by Muir & Giffard (1924-9) and Dr. Osborn (1929-110 and 1935-239), is quite common generally on low vegetation in the mountains and at the edge of coffee groves on "cohitre," *Commelina elegans.* The nymphs produce five long filaments from the caudum, besides many smaller ones, and fine threads of wax from the thorax.

on page 157, the tenth line should read:
phyllum argenteum), coconut and other trees, as noted by Mr. Thos. H. Jones in "A List of the Coccidae of Puerto Rico" (Jour. Board of Commissioners of Agr. P. R., 1 (1): 1–16, ref. 5, San Juan, 1937).

on page 162, line 34, read "Dusting with," not "Dustin w gith."

on page 187, completing the fourth paragraph:

Miss Louise M. Russell has identified as **Bemisia tabaci** (Genn.) whiteflies collected by Mr. Julio Bird which he had used in the transmission of a mosaic disease of "tuatúa", *Adenoropium gossypifolium.* She identifies as **Bemisia inconspicua** (Q.), or of the *tabaci* complex, those on other common euphorbiaceus plants, as on "lechecillo", *Euphorbia* (now *Chaemesyce*) *hypericifolia* sent to Dr. Quaintance in 1915.

on page 193, the second paragraph should read:

The chrome yellow, conspicuously marked with black **Runibia perspicua** (F.) has been found on Vieques Island, according to the determination by Mr. Barber of a specimen in the AMC (Mayagüez College) collection, dated xii-35. Mr. Barber (1939-295) describes a specimen from Bolivia as being red, but no such specimen is now in the U. S. National Museum, and all there are chrome yellow in color, as is also one recently collected by Miss Ann Wolcott on El Yunque, November 11, 1950, both adults and

nymphs on *Brunfelsia lutea* Krug & Urban, an endemic solanaceous plant, locally called "vega blanca."

On page 200, line 10 from bottom, read **Exogenus** for **Xenogenus.**

on page 211, after third paragraph, add:

Pygolampis pectoralis (Say), as determined by Mr. Mario Pérez, confirmed by Mr. Reece I. Sailer, was taken in a light-trap at Cidra in December 1950. This has not previously been recorded from Puerto Rico, altho earlier collections have been made: light-trap at Gurabo (Maldonado) and at Jayuya (J. A. Ramos), in 1943 and 1945.

on page 213, after first paragraph, add: **Mesoveliidae.**

Mesovelia mulsanti caraiba Jaczewski, described from others of the West Indies, Mexico and Panama, was first recorded from Puerto Rico by Dr. Alex. Wetmore (1916-41) as having been eaten by the spotted sandpiper. Mr. Barber records collection at seven localities in all parts of the Island. Dr. Hoffman found it in "charcas" at Isabela, and it has been intercepted at San Juan.

on page 216, after first paragraph, add: **Dolichomiris linearis** Reuter, as determined by Mr. Barber, has been swept from grass at Villalba.

On page 219, after line 12, add: **Engytatus geniculatus** Reuter, in grapefruit grove at Añasco.

page 223, line 6: the correct specific name for the introduced bullfrog is *catesbeiana.*

page 224: The Actual Date of Publication (Distribution in Puerto Rico) is November 7, 1950.

Dr. E. A. Chapin notes the following errata:
On Cover of No. 2, **Mordellidae** instead of **Mordelidae.**

on page 225, after first paragraph, add: **Rhysodidae.**

Mr. W. S. Fisher has identified as species of **Clinidium** beetles intercepted by Mr. R. G. Oakley on decaying wood at Adjuntas, and collected by Dr. Donald De Leon on dead "nuez moscada" tree at Guavate Camp, Cayey.

on page 227, after first paragraph, read **Carabidae,** not **Carbidae.**

on page 228, line 9, **Ardistomis** is correct. Dr. Chapin writes that "the spelling *Ardistomus* was used apparently without authority in the Junk catalogue and that is where Blackwelder picked up the name."

on page 229, in seventh paragraph, add: **Perigona nigriceps** Dejean also occurs in Puerto Rico (Blackwelder 1944-44), this being possibly what is listed by Dr. Gundlach as *Trechius* (not *Trechus* Vlairville, *in* Blackwelder 1944-32) *substriatus* Chevrolat "acaso nombre inedito; existe tambien en Cuba."

on page 230, last line, Dejean is correct, not DeJean.

on page 231, line 6, *Rhombodera* is correct, not *Rhomobodera.*

on page 233, line 7 from bottom, read *cumscripta,* not *cunscripta.*

on page 235, between **Catopidae** and **Limnebidae,** add: **Leiodidae.**

Mr. R. G. Oakley intercepted on pods of *Inga vera* at Juana Diaz some beetles identified by Mr. W. S. Fisher as being a species of **Aglyptinus.**

on page 235, line 9 from bottom, read **testaceus,** not **testaceous.**

on page 246, line 9, **Passalidae** is correct, not **Lucanidae, Stag Beetles.**

on page 246, line 5 from bottom, read *Pinotus,* not *Copris.*

on page 264, "the change of name from **Ligyrus tumulosus** to **Ligyrus cuniculus** was made by Arrow in the Junk catalogue, Part 156, p. 37, 1937."

Insert on page 269, after **Byrrhidae.**

Chelonaridae

Chelonarium punctatum Fabricius, originally described from Cuba, where Dr. Gundlach states "no es rara," is a most unique dark, little, oval beetle, flecked above with bluish-white, which has its head on the ventral surface of the prothorax. "Playing 'possum," with its legs closely appressed to the body, it looks more like a seed than a beetle. Collected by both Drs. Stahl and Gundlach, the family was omitted by Dr. Blackwelder from its proper place in his list, and appears as "ADDENDA," pp. 923–925, with the Puerto Rican species listed on page 924. The beetle occurs in all parts of the Island, adults having been noted under such a variety of conditions, resting on host, as to indicate none of significance but the discovery of a pair in coitu, October 2, 1923, at Río Piedras, in recently cut banana corm, placed on the ground in a banana plantation for the collection of adults of the corm weevil, *Cosmopolites sordida* Germar. Mr. Francisco Seín found two pupae inside shed larval skins in a rotten tree stump at Lares, June 14, 1921, from one of which an adult emerged that was identified by Dr. E. A. Schwarz, all of this material now being in the National Museum. Elytra have been noted in bird dung at Camuy,

and in an excrement pellet of *Bufo marinus* at Río Piedras, thus apparently the beetles are sufficiently common to be a minor item in the food of both birds and toads.

on page 270, line 7, read *navicularis*, not *nauicularis*.

on page 277, line 3 from bottom, read *impressa*, not *impresa*.

on page 280, line 13, read **Taphrocerus,** not **Taphocerus.**

on page 197, line 1, read *Epuraea*, not *Epurma*.

on page 301, line 3 from bottom, read *varivestis*, not *varvestis*.

on page 309, line 14 from bottom, read aberration, not aberation.

on page 312, line 11 from bottom, read **Coelophora,** not **Coleophora.**

on page 313, line 1, read *Coelophora*, not *Coleophora*.

on page 326, line 2, read **Trientoma,** not **Treintoma.**

on page 328, line 13, read A. J. Mutchler, not, J. A. Mutchler.

on page 369, the paragraph beginning **Podagrica cyanipennis** Weise, should continue:

As a *Cyrsylus*, Mrs. Doris H. Blake (Jour. Washington Academy of Sciences, **39** (11): 367–371, pl. 1, Washington, D. C., November 18, 1949), records collection by Mr. August Busck, at Fajardo in February 1899.

on page 375, last line, read **rufimanus** for **rufinanus.**

on page 377, line 7 from bottom, read **Homoeocloeus,** not **Homocloeus.**

on page 381, line 20, read Montserrat, not Monteserrat.

on page 403, line 8 from bottom, add: and of *Erodiscus* eaten by the killdeer.

on page 415, line 4 from bottom, add: and those intercepted by him on rotten wood in the mountains back of Yauco as a species *Ulosomus* and of **Dryophthorus.**

on page 416: Actual Date of Publication (distribution in Puerto Rico): February 5, 1951.

on page 431, end of third paragraph, add:

The results of this abruptly terminated investigation are reported as "Field Studies on the Bionomics of *Anopheles albimanus*, Part 1: Aestiva-

tion of Immature Stages—Progress Report" (Jour. National Malaria Society, **9**(2): 176–180, fig. 2., June 1950) and "Parts II and III: Diurnal Resting Places—Progress Report" (*idem.* **9**(3): 268–279, September 1950).

on page 473, 7th paragraph, add: Mr. C. W. Sabrosky identified as **armigera** (Townsend) flies reared from larvae of *Melipotis fasciolaris* (Hübner), the lingnum-vitae looper caterpillar, very abundant north of Salinas in March 1951.

on page 510, end of first paragraph, add:

In numerous fruits of the date palm, *Phoenix dactylifera* L., at Aguada, November 4, 1950, Mr. C. E. Stringer, Jr., intercepted maggots which when reared to adult were identified by Dr. Alan Stone as being *Anastrepha mombinpraeoptans.*

on page 510: in eighth line from bottom, add:

From fruits of the "almendrón", *Prunus occidentalis* Swartz, at Jayuya on June 12, 1951, flies were reared which proved to *Anastrepha suspensa.*

on page 511, after first paragraph, add:

Polymorphomyia basilica Snow, as identified by Dr. Aldrich from material reared by Dr. Richard T. Cotton from elongate oval gall in stem of "Santa María," *Eupatorium odoratum*, at Río Piedras, has also been recorded by Dr. Curran at Naguabo and Aibonito, and intercepted at Adjuntas.

on page 579, line 7 from bottom, read **Depiopeia,** not **Deiopeia.**

on page 600, line 2 from bottom, read *Encalypta*, not *Eucalypta.*

on page 633, after third line, add:

A perfect unrubbed adult of **Hemeroplanes parce** Fabricius, the silver-spotted sphinx, not previously reported from Puerto Rico, was found by Mr. Gaspar Rivera under a bougainvillea bush at Río Piedras, June 27, 1951.

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